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# Tuberculosis and the Student Nurse

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IN 1935 we reported a ten-year survey on infection, morbidity, and mortality from pulmonary tuberculosis in student nurses. At that time we felt that the conclusions justified the plea for a more thorough examination of young women who enter training schools in our general hospitals. We further suggested chest roentgenograms semi-annually or oftener if unexplained symptoms appeared, and finally greater protection for student nurses from unknown infectors in general hospitals.

As a result of the many articles written on this subject, nearly all of the training schools in the hospitals in the Maritime Provinces have adopted routine chest films of each student nurse at the beginning of her training, and at intervals during the course. A few hospitals have introduced tuberculin-testing and have found that the number of positive reactors is comparable to those in other walks of life in the same age group. This of course is to be expected.

At least one hospital requires routine sputum examination of all patients entering the hospital for treatment.

We now wish to present the following data, comparing infection, morbidity and mortality in the two periods, June 1930-June 1934 and a later period June 1934-June 1939. During this nine-year period we have kept accurate records on these three factors. The results are presented under four headings:

1. Morbidity before entering training, based on the student's history.
2. Morbidity and mortality during the probation period, based on history and reports from the nursing superintendents of the affiliated schools.

3. Morbidity and mortality from the end of the probation period to the beginning of the course in tuberculosis.

4. Infection, morbidity and mortality in all student nurses during and after their course in tuberculosis.

We are also including data concerning infection, morbidity and mortality in graduate nurses who have taken the post-graduate course in tuberculosis.

*Infection*

On admission to the course in tuberculosis each student receives 1/100 mg. of Old Tuberculin (Parke, Davis & Co.) and if results are negative in 48 hours 1/10 mg. of Old Tuberlin is given intradermally. If both prove negative, the tests are repeated at the end of the course. This routine was introduced in June 1930 and has been continued. The findings in student and graduate nurses during the years 1930-34 and 1934-39 are presented in table 1.

TABLE 1

RESULTS OF TUBERCULIN TESTING IN STUDENT AND GRADUATE NURSES

| | 1930–1934 | | 1934–1939 | |
|---|---|---|---|---|
| | Student nurses | Graduate nurses | Student nurses | Graduate nurses |
| Number tested | 275 | 48 | 218 | 63 |
| Per cent positive | 84 | 98 | 66.5 | 90.5 |
| Per cent negative | 16 | 2 | 33.5 | 9.5 |
| Per cent still negative at end of tuberculosis course | 7 | 0 | 20 | 6.3 |
| Per cent negative at start of course, positive at end | 9 | 2 | 13.5 | 3.2 |

An evident drop in positive reactors has occurred in both student and graduate nurses. In the latter group the reduction has been much less. Little change has occurred in the conversion of negative reactors to positive during the course in tuberculosis.

During the same nine-year period there has been a notable decline in tuberculin-positive young people in the same or approximate age-groups.

In 1932, 42 per cent of a class of 350 normal-school students (girls), of the approximate age of the student nurses gave positive tuberculin reactions. In 1938, 600 vocational students averaging three years younger demonstrated 20 per cent to be positive reactors. These surveys related to young people living in the same part of Canada, and of the same family background, as the student nurses.

*Morbidity and Mortality*

The findings relating to morbidity and mortality are presented in table 2. The greatest reduction in the morbidity rate occurred during the probation period. Obviously more care was exercised in the selection of students, and those whose X-ray films revealed definite or suspicious findings were not accepted.

TABLE 2

MORBIDITY AND MORTALITY FROM TUBERCULOSIS IN STUDENT AND GRADUATE NURSES

| | Number | Morbidity per cent | | | | Mortality per cent |
|---|---|---|---|---|---|---|
| | | To end of probation period | Probation period to beginning of course in tuberculosis | During tuberculosis course and after | Total | |
| **1930–1934** | | | | | | |
| Student nurses | 616 | 3 | 3.5 | 1.6 | 8.1 | 0.48 |
| Graduate nurses | 48 | | 2 | | 2 | |
| **1934–1939** | | | | | | |
| Student nurses | 218 | 0.9 | 3.7 | 2.3 | 6.9 | 0.45 |
| Graduate nurses | 63 | | 3.2 | | 3.2 | |

Note: The number of undergraduates in the 1930-34 and the 1934-39 study comprised not only those who took the course in tuberculosis at the Saint John Tuberculosis Hospital but all those who had entered training in the affiliated hospitals. Since 1934 some of the schools have discontinued their affiliation.

Very little change has occurred following the probation period. Neither the general hospital affiliated with the Saint John Tuberculosis Hospital nor the latter have been successful in reducing the incidence of tuberculosis.

Important points regarding the development of tuberculosis in student nurses during the period 1934-39 are presented in table 3.

The two student nurses who developed tuberculosis two or more years after graduation remained tuberculin-negative throughout the course in tuberculosis. At a later date both nurses cared for tuberculous patients with positive sputum. Both patients were very ill.

At this point we should like to point out that every student nurse who developed tuberculosis either during the course or subsequently, with the exception of the two nurses mentioned above, had a positive intradermic reaction before she began her training in the Saint John Tuberculosis Hospital. This was also true of the nurses developing tuberculosis during the survey of 1930-1934.

The yearly percentage morbidity is 1.7. We may well ask what would be the percentage in an identical age group under the same experimental conditions, that is, not the result of a single examination, but a complete follow-up for a period of four years.

## CONCLUSIONS

We feel the following conclusions are justified, based on our records on student nurses for fifteen years.

TABLE 3

INFECTION, MORBIDITY, AND MORTALITY FROM TUBERCULOSIS IN NURSES DURING AND AFTER THEIR COURSE

| Name | Tuberculin reaction at beginning of course in tuberculosis | Type of disease | End result |
|---|---|---|---|
| **Nurses with tuberculosis before training but accepted** | | | |
| J. B. | 2+ | Dry pleurisy | Well |
| E. McD. | 2+ | Pleurisy with effusion | Well |
| **End of probation period to beginning of course in tuberculosis** | | | |
| H. H. | 2+ | Acute parenchymatous | Treatment, well |
| L. Mc. | 1+ | Parenchymatous | Well |
| E. O. | neg. | Dry pleurisy | Well |
| L. B. | 4+ | Parenchymatous | On treatment |
| M. W. | 3+ | Dry pleurisy | Well |
| T. W. | 2+ | Parenchymatous | Well |
| E. D. | 2+ | Dry pleurisy | Well |
| G. B. | 2+ | Parenchymatous | Well |
| **During or following course in tuberculosis hospital** | | | |
| M. S. | 1+ | Parenchymatous | Well |
| V. B. | 1+ | Parenchymatous 3 mos. following course | Well |
| D. B. | 2+ | Dry pleurisy during course | Well |
| G. F. | 1+ | Meningitis 6 months following course | Dead |
| E. S. | 2+ | Parenchymatous | On treatment |
| **Two or more years following graduation** | | | |
| W. C. | Neg. to .01—.1 mg. O.T. at beginning of course, neg. to same dosage at end of course | Pleurisy with effusion | Well |
| L. VanB. | Neg. to .01—.1 mg. O.T. at beginning of course, neg. to same dosage at end of course | Pleurisy with effusion | Well |

1. The number of tuberculin-negative student nurses in the affiliated course in tuberculosis at the Saint John Tuberculosis Hospital is definitely increasing in line with the generally decreased infection rate.

2. Ninety per cent of the graduate nurses at the beginning of the post-graduate course in tuberculosis still react positively to tuberculin. There has been little change over a ten-year period.

3. The experience in our affiliated hospitals does not lead us to believe that

the morbidity from tuberculosis among student nurses has materially changed in ten years, except during the probation period.

4. There has been little change in the morbidity rate in student nurses who have taken a special course in tuberculosis nursing.

5. We still find that in nearly every instance wherein a student-nurse breaks down either during the course or within one year, there has been present a positive intradermic reaction when the student nurse began the course in tuberculosis.

6. There would appear to be an elimination of types less resistant to tuberculosis during the period of training, age-period 18 to 23 years. The nurses in the post-graduate course, despite the fact that over 90 per cent react positively to tuberculin, still have not developed active tuberculosis in the ten-year period. Four had pre-existing disease developing either before their general hospital training or a short time later with further breakdowns.

This is in distinct contrast to the collected figures (4.07 per cent) on morbidity among graduate nurses working in our Canadian sanatoria over a period of four years, reported by ourselves in 1935.

ACKNOWLEDGMENT

We wish to thank the superintendents of nurses of the various affiliated training schools both past and present, who so kindly supplied statistical data regarding their own personnel.

REFERENCES

Collins, R. J. and MacMillan, C. W.: Tuberculosis and the Student Nurse. Canad. M. A. J., 1936, *34*: 649.

Data secured from Canadian sanatoria, 1935. Personal communications.

Further references have already been given in former articles.

# Some Observations on Canadian Nutrition*

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IT is now widely recognized that nutrition is one of a number of factors which influence public health. To ensure proper nutrition, it is obviously essential that we have adequate supplies of the right kinds of food and that these be prepared in such a way that the nutritive value is not impaired.

There is general agreement regarding the food constituents which should be furnished for optimal nutrition. Each person must secure sufficient carbohydrate, fat and protein to satisfy his or her energy requirement. The demand for energy varies with age, sex and occupation and I refer you to the Canadian dietary standard for details of energy requirements.

The diet must contain adequate amounts of protein. Proportionately, the amount required is greater for children and for pregnant and nursing mothers. If the quantity of protein is equivalent to 10 to 14 per cent of the total calories, it will be sufficient. It is well to remember that from one-third to one-half of the protein should be from animal sources to ensure supplies of the essential amino acids.

All of the necessary mineral elements must be supplied. Under ordinary conditions, ample quantities of most of these will be furnished but surveys have shown that there may be insufficient amounts of calcium, iron and iodine. Special attention should be paid to these elements to ensure adequate supplies.

It is now clear that humans need at least seven vitamins. These are: A; thiamin or B1; riboflavin; B6; nicotinic acid; ascorbic acid; and D. It is entirely likely that others, now known to be required by various species of animals, will shortly be shown to be essential for humans.

The supply of food cannot, then, be considered to be adequate unless it satisfies the individual's energy requirements, furnishes proper amounts of protein, and supplies all the needed mineral elements and vitamins. This definition of adequacy only becomes practical when it is translated into actual foods. It is readily possible to secure an adequate diet, with the possible exception of one constituent, from common Canadian foods. That exception is vitamin D; children, especially, should be given during the winter months a source of vitamin D such as a fish-liver oil. In choosing foods, special emphasis should be given to the protective ones, milk, eggs, fruits and vegetables, which supply mineral elements and vitamins.

During recent years, some fairly accurate information has been accumulated

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regarding deficiencies in Canadian dietary habits. In Toronto two dietary surveys have been conducted, the first by a local committee among families receiving less than $1,000 per year, and the second by members of the staff of the School of Hygiene, under the auspices of the Canadian Council on Nutrition, among families receiving incomes from $1,500 to $2,400 a year. A consideration of the results of these surveys shows deficiencies which now exist, provides some explanation for their existence, and indicates preventive measures.

In families having incomes below $1,000 per year, the Toronto survey showed that only three per cent received a supply of calories which would be considered adequate, while the average for the group of 100 families was 76.5 per cent of the standard recommended by the Canadian Council on Nutrition. The protein supply was 77 per cent of standard, calcium 69 per cent, and iron 62 per cent. It is clear that the total supply of food available to these families was insufficient.

One criticism which has been brought against these results is that the standard used as a criterion of adequacy is set so high that it could be attained only with difficulty. Results from the survey of families having annual incomes between $1,500 and $2,400 clearly refute this criticism and provide valuable comparisons with the previous survey. In the higher income group, the average supply of calories per family was 93 per cent of the Canadian standard, protein 95 per cent, calcium 116 per cent, and iron 99 per cent. The average picture of this group of 80 families shows that they were receiving adequate supplies of food and that the Canadian dietary standard is easily attained.

Last year the Dominion Bureau of Statistics, in connection with a study of family budgets, secured evidence regarding food consumption in a number of municipalities. The results are in accordance with those found in the two Toronto surveys.

If we accept these results as indicative of general conditions, we are forced to the conclusion that an appreciable number of our urban people are not properly fed. So far, data regarding rural conditions have not been secured. With regard to urban diets we can make a prediction with some certainty: that the average picture among those families with the lowest incomes is one of undernutrition. We have good reason for thinking that these people secure an insufficient total amount of food and that there are deficiencies, particularly among the women and children, of protein, calcium, iron and most of the vitamins.

The obvious conclusion is that this undernutrition is due to financial inability to buy proper foods in the right amounts. Undoubtedly this is an important cause but we have evidence that there is another factor, for which preventive measures can be more easily undertaken. That factor is lack of nutritional knowledge, including not only information regarding the right food to use but also the most economical ways of buying and preparing foods. Appreciable improvements in nutrition could be brought about by educational measures.

An improvement in the nutritional status of our civilian population could be regarded as a legitimate part of the war effort. During the past winter, a scientific committee assisted the Department of National Defence in raising the

nutritive value of army rations. We would all regard that as definitely useful. There are good reasons for thinking that raising the nutritional status of civilians would also be valuable. We would all agree that nutrition is a factor in maintaining public health; surely this is a time to maintain public health on as high a level as possible. The studies of Haggard at Yale University have shown that working efficiency is influenced by nutrition. If we are to produce war supplies intensively it will be advisable to have our workers properly fed.

There is another aspect of an improvement in nutrition, that concerning markets for Canadian agricultural products. An increase in nutritional status implies an increased use of a number of foods. So far the war has caused augmented exports of a few Canadian foodstuffs and caused a marked diminution in exports of others. On the whole it has not improved the position of the Canadian farmer. Conditions may change rapidly but at present there is no justification for war gardens or for a marked increase in home canning. The problem of disposal of surpluses of foods which cannot be exported is acute. At the same time, the Dominion Government has repeatedly urged against unnecessary use of foreign exchange. It is advisable to increase the consumption of those Canadian farm products which cannot be exported and to limit the importation of foods which we do not really need.

One caution regarding the effort to encourage the consumption of Canadian foods is in order. Inaccurate and misleading statements regarding the nutritive value of a food should not be permitted. During the past winter, a concerted effort was made to increase the sale of apple juice. This product is a fine beverage; used as such it has admirable qualities. However, the statement was repeatedly made in the press that apple juice and orange juice are equivalent in vitamin content. Such is not the case. Twenty-five times as much apple juice, as it is on sale in Toronto, is needed to give as much vitamin C as does orange juice. Persons who have been relying largely upon orange juice to supply vitamin C and who discontinue that source to use apple juice would receive most inadequate supplies of the vitamin. These statements do not mean that we should not use apple juice nor that we must use orange juice. It should be emphasized that apple juice, although it is not a good source of vitamin C, is a more wholesome beverage than many drinks now in common use. It should also be made clear that Canadian fresh and canned tomatoes, tomato juice, potatoes, turnips and other fruits and vegetables are good sources of vitamin C and can replace imported citrus fruits.

Dietary surveys in Toronto have shown that, in low-income families, the supply of calcium is insufficient, particularly in the case of children. This is directly due to a small use of milk and one reason may be that such families cannot afford to buy sufficient quantities. Another reason may be a lack of appreciation of the value of milk. This food is a cheap source of calcium, of vitamin A and of other constituents. If the situation does actually exist that some families cannot afford to buy proper amounts of whole milk, they should be encouraged to purchase as much as they can afford and to increase the calcium intake by the use of skim milk and cheese. While skim milk lacks vitamin A and fat, it

contains as much calcium as does whole milk. It would be best for children to use enough whole milk to take care of the calcium requirement; failing that, they should have skim milk and cheese to prevent a calcium deficiency. One other observation should be made regarding the use of milk. In the Toronto survey of families receiving $1,500 to $2,400 per year, the lowest intake of calcium and milk was found in teen-age girls. The likely explanation is a current desire on the part of girls to be slim. These girls obviously lacked information about foods because they gave up the use of milk and ate generously of other foods which are more fattening. As a public health measure, it would be an advantage to teach these girls that it is much better to be properly fed and healthy than to be thin, although both can be accomplished if an adequate knowledge of nutrition is available.

It has been frequently pointed out that there is likelihood of many families receiving insufficient supplies of the B vitamins. That is most probably the case in low-income families. In such families, the consumption of bread is considerable and most people prefer to use white bread. It is well known that the process used in the production of white flour removes a great deal of the mineral and vitamin content of wheat. Consequently, advice has frequently been given to use whole-wheat bread. The amount of whole-wheat flour used in so-called whole-wheat bread varies considerably. A regulation to fix the amount of whole-wheat flour which must be used if bread is to be called whole wheat is badly needed. There is, moreover, the practical difficulty that white bread is preferred by most people. The suggestion has been made that thiamin, or vitamin $B_1$, should be added to white flour. This will not solve the problem. Thiamin is only one of a group of eight or more members of the vitamin B complex, all of which are needed. The members of this group have conjoint physiological functions. They are all present in wheat germ and equal shares of all are removed in milling white flour. The addition of one only of the vitamins which are lost in making white flour is not the answer. In the School of Hygiene we have recently conducted investigations regarding this problem. Animal feeding experiments with bread purchased in Toronto have shown that brown bread containing twenty per cent whole-wheat flour is definitely superior to white bread. The addition of thiamin to white bread causes no better growth in young animals than does the bread alone. White bread can be given the vitamin content of brown bread by the addition of yeast or of wheat germ. Animal tests have shown that the addition of five per cent wheat germ to white bread raises its nutritive value to that of bread containing twenty per cent whole-wheat flour. White bread, thus improved, has changed very little in appearance and in flavour. The compulsory addition of wheat germ to white bread would increase the intake of the B vitamins, particularly in low-income families, where large quantities of bread are consumed, and where liberal quantities of foods rich in these vitamins cannot be afforded.

During the past winter an extensive experiment in nutrition education was carried out in Toronto. Under the auspices of the Health League of Canada, nutrition classes were conducted by trained teachers, following a curriculum

devised by a special committee. At first, accommodation for 800 women was available; this was doubled as a result of requests to attend the classes. Emphasis in teaching was placed upon economical purchasing and preparation of foods. This type of educational work should be greatly extended.

There is immediate need in Canada for a national program of nutrition. The primary object should be to improve the nutrition of our people. A widespread educational campaign based on accurate information could accomplish a great deal. Attention should be given to the disposal of agricultural products which cannot be exported, under present conditions. This is a matter of national importance. It is equally important that nutrition should be considered as one of a number of factors which influence public health and working efficiency.

# Developments in Public Health in Montreal During the Past Three Years*

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PUBLIC health, being a positive science, is making great strides; its progress is constant and wide-spread. To remain up-to-date and give the population the service which it has a right to expect, public health officers must, from time to time, alter their methods and bring them into line with the advances of science; in other words, they must improve their organization. The horrors of war must not cause us to neglect our duties and responsibilities. To assure ourselves that the health of the public is good is more than ever our obligation. Montreal should not be behind in this domain, and I must acknowledge with gratitude the generosity of our administrators who have given us, even during these hard times, means to carry on our work and even to make it easier.

The Department of Health of Montreal was established in 1876. Its progress was slow at first, and it underwent many changes and improvements. In 1918 it was given its first impetus. In 1928, following a survey of the public health services of the city, it was reorganized and placed on a modern basis with the object in view of giving the public the greatest possible service.

That is what the Montreal Department of Health has striven to do, within the limits of the budget allotted to it. In this paper I shall deal only with the improvements effected since January 1, 1938, the date on which the City administrators entrusted me with the management of the department. Many of the changes that have been made were suggested in the report of the survey of 1928.

Preliminary to the organization of health districts in the city and the introduction of other modern improvements in the department, the director's office was reorganized. Two assistant directors were appointed, one being in charge of publicity and propaganda and the other responsible for personnel and office management. The legal division was abolished and the attorney in charge was assigned to the director's office.

## City Health Districts

During 1939 the Department of Health initiated the organization of health districts. Both from the point of view of health and of administration there are advantages in thus dividing a city the size of Montreal, and it is planned ulti-

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mately to provide seven or eight districts, the management of which will be entrusted to the child hygiene division. Before introducing this plan of organization, we visited other large cities, chiefly New York and Toronto, in which this system is in use, and also reviewed the experience of Baltimore, Boston, and other centres.

Each district will be under the supervision of an experienced physician qualified in public health and having the title of "district health officer." It will have an administrative office known as the health centre, with the offices of the district health officer and his staff, and accommodation for the various clinics providing prenatal supervision and the supervision of infants and preschool children, as well as dental and mental hygiene clinics.

The organization of the first district was completed in November, 1939. A second district was opened in September of this year. District no. 1 is known as Maisonneuve and district no. 2 as St. James. The latter district includes that part of the city which is called "Old Montreal" and in it are the medical and dental faculties of the University of Montreal. This district offers an excellent opportunity for field study and for the training of medical students and nurses in public health.

Statistical data for the two districts are presented in table 1.

TABLE 1

POPULATION AND BIRTH AND DEATH RATES IN DISTRICTS NO. 1 AND NO. 2

| | *Sanitary Districts* | |
|---|---|---|
| | No. 1 Maisonneuve | No. 2 St. James |
| Area | 6,403 | 1,727 |
| Population | 101,241 | 140,600 |
| School | 20,000 | 18,887 |
| Birth rate | 20.6 | 19.0 |
| General death rate | 9.0 | 11.4 |
| Infant death rate | 76.6 | 65.8 |
| Death rate from tuberculosis | 80.0 | 96.0 |

It will be noted that the districts contain large populations, 101,241 in district no. 1 (Maisonneuve) and 140,600 in district no. 2 (St. James). In district no. 1 there are thirty-nine schools and eleven baby and prenatal clinics, of which seven are conducted under the auspices of the City and four by independent organizations. In district no. 2 there are thirty-nine schools and eight baby and prenatal clinics, three of which are conducted by the City and five by independent organizations. A branch of the Bruchési Institut provides for the diagnosis of tuberculosis in district no. 1, and in district no. 2 the need is met by another branch of this institute and by two branches of the Royal Edward Sanatorium. A dental clinic is provided in district no. 1 by the City and in district no. 2 there are two dental clinics and a clinic for orthodontia. There are six hospitals or other institutions in district no. 1 and four in district no. 2.

The personnel of the two districts is presented in table 2.

TABLE 2

PERSONNEL OF HEALTH DISTRICTS No. 1 AND No. 2

| | District No. 1 | District No. 2 |
|---|---|---|
| District Health Officer | 1 | 1 |
| Physician inspectors | 2 | 2 |
| Psychiatrist (t.p.) | 1 | 1 |
| Dentist | 1 | 1 |
| Orthodontist | — | 1 |
| Supervising nurse | 1 | 1 |
| Visiting nurses | 17 | 13 |
| Psychological nurse | 1 | — |
| Assistants for each dental clinic | 1 | 1 |
| Technician—orthodontic clinic | — | 1 |
| Stenographer-typist | 1 | 1 |
| Total | 26 | 23 |

We intend to organize a third district during the winter, and it is hoped that within a very few years the city will be completely organized into seven or eight health districts.

## ORGANIZATION OF A TUBERCULOSIS SECTION

The formation of a tuberculosis section in the contagious diseases division of the Department of Health in October 1938, to correlate the work of various existing anti-tuberculosis organizations in the city and to carry forward an active campaign planned by the Department for the control of this disease, was one of the most important improvements made during the past three years. Formerly the Department's contribution had consisted of grants to anti-tuberculosis dispensaries and institutions, and to health camps; payments for the maintenance of tuberculosis patients in the Sacred Heart Hospital; and other indirect assistance including medical inspection in schools, which had been in effect since 1906, the medical examination of lay teachers, in effect since 1933, the inspection of food handlers, and the enforcement of building by-laws.

The new tuberculosis section has as its objective the more effective control of tuberculosis. It will work jointly with the anti-tuberculosis institutions in the city. It is seeking to obtain the more complete reporting of tuberculosis cases by physicians and has established a central record system. This will make possible the supervision of all contact cases and epidemiological investigations will be conducted to trace the source of infection. The necessary measures will be taken for the supervision of the patient at home and for the protection of those around him. The division will also supervise the placing of tuberculosis cases in sanatoria. To assist physicians and institutions in the control of this disease, we have established a system of free distribution of tuberculin.

In 1938 tuberculin testing was commenced in public clinics. Those showing positive reactions are given X-ray examination and are followed closely by the staff of the tuberculosis section in an endeavour to trace the source of the infection. The patients are referred to the family physician. This work will be extended to children in the higher school grades in the fall.

To meet the needs of this work, a municipal radiology clinic was opened in

February 1940 to provide for the examination of contacts of all poor patients sent by a physician and for the examination of children who are found to be tuberculin-positive and whose physical condition is not satisfactory. The report of the X-ray examination is sent only to the family physician; no information is given to the patient. No treatments whatsoever are given at the clinic: its sole object is to serve the medical profession and the cause of public health.

The formation of this clinic has made possible the establishment of a system of medical examinations, including X-ray, for all applicants for employment in the civic service. Such an examination is required of every applicant before appointment.

The section is under the direction of Dr. Ladouceur, a tuberculosis specialist who has had a wide experience. There is a supervising nurse and a staff of four nurses including an X-ray specialist.

Reference must be made to the active participation of the Department of Health in the campaign against tuberculosis undertaken by the Provincial Defence Committee and the Provincial Ministry of Health. This campaign was commenced in 1937, and although it was planned to conduct it for only three years, it is being actively carried on, reaching every part of the province. The Department of Health was responsible for the publicity campaign in the City of Montreal.

### SECTION OF DENTAL HYGIENE

We have effected a certain amount of reorganization in the dental hygiene section, in the child hygiene division, by appointing at its head a dentist who is "section head". His work consists in organizing the work of this section, which comprises the dental inspection of school pupils and the launching of dental campaigns, and also the visiting of city dental clinics.

Pursuant to an agreement between the Faculty of Dental Surgery of the University of Montreal and the City Department of Health, a "municipal orthodontia clinic" was opened in the dental school on February 12, 1940. This special clinic is under the direction of the head of the orthodontia service in the dental faculty, Dr. Paul Geoffrion, who was appointed by the City to be in charge of this clinic. The clinic deals only with the straightening of teeth and is for the use of children whose parents cannot afford such services.

### REORGANIZATION OF THE MILK INSPECTION DIVISION

The inspection of milk is part of the duties of section no. 1 of the food inspection division. Its purpose is to assure control over milk received and sold in Montreal, in conformity with the provisions of by-law no. 891. This inspection is carried out for milk, cream, and their by-products.

To make it more effective and complete, in spite of the good results obtained, the section was reorganized into two sub-sections, each under the direction of a section head. The inspection of milk in restaurants, grocery stores, and dining rooms, etc., was entrusted to inspectors in the restaurant section. A doctor quali-

fied in public health (M.P.H.) was appointed assistant superintendent of the milk inspection division. The number of milk inspectors was increased and the office staff augmented. A manual of instruction was prepared and distributed to all inspectors of the milk inspection division and they were urged to follow its requirements strictly.

### DIVISION OF PUBLIC HEALTH EDUCATION

A bureau of public health education was created as part of the director's office. The work is conducted by the Department's assistant director in charge of publicity and propaganda.

### LABORATORY DIVISION

Following the appointment of a new superintendent of laboratories, the work was divided into three sections. Bacteriological work is under the direct control of the superintendent, who is a doctor and bacteriologist, assisted by two physicians who are bacteriologists, and a technical assistant. The bacteriological control of milk and water is under the control of a chemist, assisted by an analyst and helper. Chemical examinations are under the direction of a chemist, assisted by an analyst. The introduction of the phosphatase test in 1938 in the laboratories has afforded a greater control over pasteurization. Since that date also typing of pneumococci in sputum has been provided, thus assisting physicians in the treatment of cases of pneumonia.

### OTHER IMPROVEMENTS

In the division of sanitation a third section was established with the appointment of a section head to provide services in connection with special by-laws. Since 1938 three new by-laws have been adopted and deal with massage parlours and masseurs, funeral directors and embalmers, and control of nuisances.

In 1938 the Department of Health felt that it was opportune to limit the extent of free vaccination services, placing in the hands of the medical profession a greater share of this work. Only destitute persons may obtain free vaccination from civic or other public agencies. Those who are considered able to pay for this service are advised to apply to their family physician.

Through the school medical inspection service, family physicians are now informed, by personal letter, of physical defects found which require medical attention. A manual of school medical inspection has been prepared and published. The number of public health nurses has been increased from 127 to 136 and additional equipment has been purchased, including two photometers.

In the child hygiene division we are studying the need for supervision of day nurseries and kindergartens.

The improvements which I have outlined and which have been effected since 1938 have already contributed toward the better health and longer life of the citizens of Montreal. Adequate support for this statement is furnished by the statistical data in table 3, in which the vital statistics of Montreal for the years

TABLE 3

POPULATION, BIRTH RATE, GENERAL MORTALITY, MATERNAL MORTALITY, INFANT MORTALITY, MORTALITY FROM TUBERCULOSIS, MONTREAL, 1915, 1939

| | *1915* | *1939* |
|---|---|---|
| Population | 516,000 | 900,000 |
| Births per 1,000 population | 40.10 | 19.02 |
| Deaths per 1,000 population | 19.48 | 10.21 |
| MATERNAL MORTALITY | | |
| Rate per 1,000 live births | 4.11 | 3.16 |
| INFANT MORTALITY (0-1 year) | | |
| Per 1,000 live births | 182.6 | 71.5 |
| Deaths from diarrhoea (0-1 year) | | |
| Per 1,000 births | 82.73[1] | 13.9 |
| TUBERCULOSIS per 100,000 | 205.81 | 70.10 |
| (a) pulmonary | 160.66 | 60.2 |
| (b) other forms | 45.15 | 9.9 |

1915 and 1939 are presented. The infant mortality rate, the maternal mortality rate, and the tuberculosis mortality rate are the lowest ever recorded in Montreal, and it is my ardent wish that they may continue to diminish.

[1]The number of deaths from diarrhoea (0-1 year) is not indicated in the Report for 1915. It has been estimated as 6.62 per cent of the deaths from this cause in children from 0 to 2 years. This proportion of 6.62 per cent has been based on the mean for the five years 1920-25.

# Highlights on Hospitalization in Ontario*

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MORE than thirteen million dollars will be spent on hospital care for general sickness this year in Ontario. This is more than $3.40 for each person living in the province. Of the total hospital income approximately 60 per cent will be contributed by the patients themselves, almost one quarter by the municipal authorities and over 9 per cent, or almost one and a quarter million dollars, by the provincial government.

These figures are limited to public general hospitals, and while they therefore exclude all tuberculosis and mental hospitals, homes for incurables, and private hospitals, they cover 95 per cent of the hospitalization for general sickness in the province. It is the object of this address to indicate some of the statistical highlights of such hospitalization (1) (2), including the extent, distribution and use of present facilities, trends in hospitalization and hospital costs, the diseases and conditions responsible for hospitalization, the nature of the hospital clientele, the use of hospital care by pay and non-pay patients, and the future outlook of hospitals for general sickness in Ontario.

*The Present Facilities*

One hundred and forty-six public hospitals, with a capacity of 15,266 beds, provide the present facilities for general hospital care. These hospitals represent 116 different communities in Ontario (figure 1). The distribution of the total bed accommodation and days of service by size of hospital is presented in table 1.

TABLE 1

ONTARIO PUBLIC GENERAL HOSPITALS BY SIZE
DISTRIBUTION OF FACILITIES, 1938

| Group | Number of Beds | Hospitals | | Beds | | Total Days' Stay | |
|---|---|---|---|---|---|---|---|
| | | Number | Per cent | Number | Per cent | Number | Per cent |
| I | 1 - 25 | 9 | 6.2 | 194 | 1.27 | 26,581 | 0.74 |
| II | 26 - 50 | 37 | 25.3 | 1,385 | 9.07 | 274,798 | 7.68 |
| III | 51 - 100 | 27 | 18.5 | 2,017 | 13.39 | 423,034 | 11.82 |
| IV | 101 - 200 | 28 | 19.2 | 3,770 | 24.70 | 865,651 | 24.20 |
| V | 201+ | 16 | 11.0 | 7,499 | 49.12 | 1,909,799 | 53.38 |
| Red Cross Hospitals† | | 29 | 19.8 | 401 | 2.63 | 77,830 | 2.18 |
| All Hospitals ..... | | 146 | 100.0 | 15,266 | 100.00 | 3,577,693 | 100.00 |

†Of these, three are 25-50 beds, one 51-100 beds and others under 25 beds.

*Presented at the Stated Meeting, Academy of Medicine, Toronto, April 2, 1940.

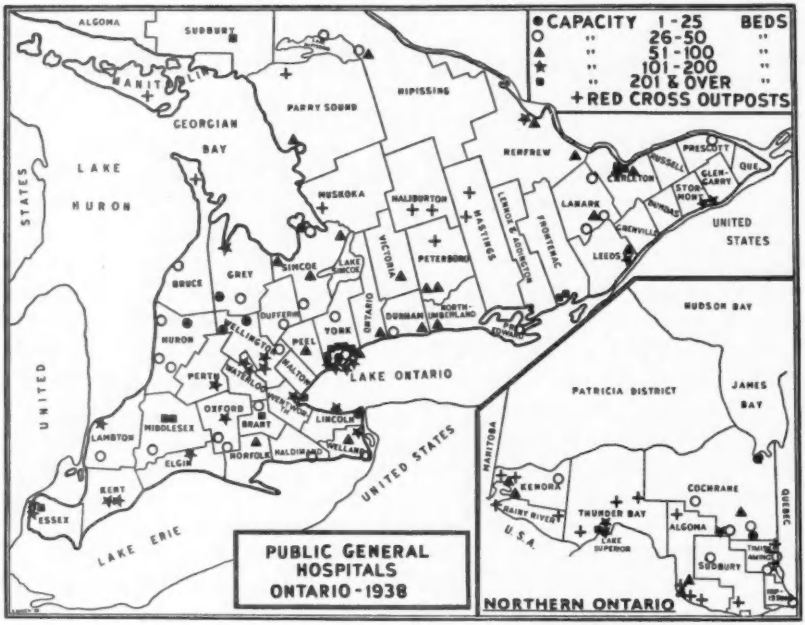


FIGURE 1

Half of the available beds are in the larger institutions with 200 beds or more, and more than half of the days of treatment annually are given in these hospitals. Of the 16 large hospitals in this category, thirteen are located in the six large cities. The concentration of facilities in the larger centres of population is indicated by table 2.

TABLE 2

HOSPITAL BEDS, PATIENTS AND DAYS BY MUNICIPALITY
ONTARIO PUBLIC GENERAL HOSPITALS, 1938

| Municipality | Per cent Distribution of | | | |
|---|---|---|---|---|
| | Beds | Patients | Days | Population |
| Toronto | 27.0 | 27.8 | 32.0 | 17.6 |
| Ottawa | 7.4 | 8.0 | 8.8 | 3.8 |
| Hamilton | 6.6 | 6.8 | 6.1 | 4.2 |
| London | 5.6 | 4.3 | 5.4 | 2.1 |
| Kingston | 3.5 | 3.4 | 3.4 | 0.7 |
| Windsor | 3.3 | 3.6 | 2.9 | 2.8 |
| Six Cities | 53.4 | 53.9 | 58.6 | 31.2 |
| Others | 46.6 | 46.1 | 41.4 | 68.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

In 1938, the six large cities—Toronto, Ottawa, Hamilton, London, Kingston and Windsor—had 53.4 per cent of all the bed accommodation, treated 53.9 per cent of the patients and gave 58.6 per cent of the total days of care. Although the population of these cities was but 31.2 per cent of the population of the province, the counties represented by these six urban centres comprised 45 per cent of the total population of the province.

*Use of Present Facilities*

In general, present facilities are not overtaxed. There is an ample margin of safety in almost every institution. Bed occupancy* on the whole is much below that regarded as indicating advantageous use of available capacity. In only 13 hospitals in 1938 was the utilization of adult beds at or above 80 per cent.

Utilization of beds is at a higher level in larger hospitals than in smaller ones. The occupancy of adult beds in group V hospitals as a whole was 75 per cent compared with 65.7 per cent in hospitals of 101-200 beds, 61.1 per cent in those of 51-100 beds, and even lower occupancies in smaller-size groups. The occupancy of private beds is generally much lower than for public beds, a factor of considerable importance in relation to hospital income. The substantially higher per cent occupancy in the larger institutions is an important factor toward more economical operation.

The extent to which use is made of the facilities of any hospital, as reflected in bed occupancy, is influenced by public attitude toward hospitalization, the standing of the hospital in the community from both public and professional standpoints, economic conditions, hospital costs, etc. The better facilities in the larger institutions undoubtedly influence public and professional opinion in favour of them.

*Trends in Hospitalization*

During the years 1909-1938, the bed accommodation available in Ontario public general hospitals rose from 5,102 to 15,266. Bed accommodation has trebled while the population has increased by only 71 per cent. A marked increase in hospitalization has therefore occurred, bringing with it a terrific increase in the burden of hospital costs upon both municipal and provincial governments.

The average size of hospitals has increased and the ratio of beds to population has almost doubled, rising from 2.2 per 1,000 population in 1911 to 4.1 in 1938. The ratio of beds per hospital death has declined from 1.8 to 1.3, reflecting, in the face of a declining mortality, a greater degree of hospitalization in fatal illnesses. Infant bed accommodation alone stood at 21.4 per 1,000 live births in 1929, but had risen to 33.5 by 1938.

Further illustrations of the trends in hospitalization are supplied by data on the hospitalization of women during childbearing and the proportion of all fatal illnesses hospitalized. In 1900 only 1.8 per cent of all live births took place in a public general hospital; in 1938 the figure stood at 47.5 per cent. Similarly, in

**The percentage ratio of the number of patient days to possible bed days during any given period.*

1900 only 5.0 per cent of all deaths in the province occurred in public general hospitals compared with 31.5 per cent in 1938. This latter trend is obscured in part by the growth of ancillary institutions.

These trends are illustrated graphically by figure 2.

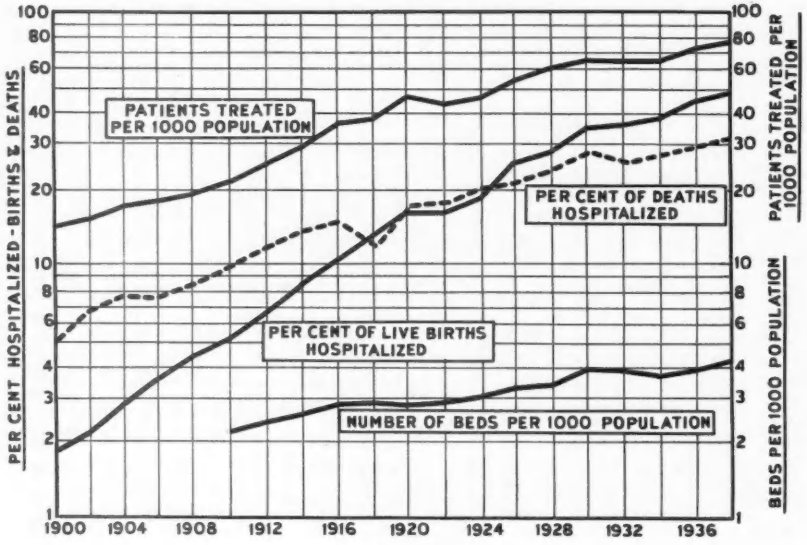


FIGURE 2

HOSPITALIZATION AND HOSPITAL ACCOMMODATION
PUBLIC GENERAL HOSPITALS
ONTARIO, 1900-1938

*The Volume of Care Provided*

Two facts are of interest in relation to the volume of hospital service: the number of patients treated and the days of care provided. In 1900 the number of patients treated was less than 30,000, or 14 per 1,000 population. By 1938 the number had increased ten-fold to just short of 300,000, or 76 per 1,000 population. Excluding newborn infants and neglecting repeat admissions, 7 per cent of the total population of this province are hospitalized in public general hospitals during a given year (table 3). In New Zealand the figure reached 6.2 per cent in 1937.

The observed five-fold increase in the hospital case rate (14 to 76 per 1,000) has been made possible not only by increase in bed accommodation but by an increase in the patient turnover. The latter has doubled since 1908, rising from 9.04 patients per bed to 18.46 in 1938. Shorter stay arising from a change in the nature of conditions for which patients are hospitalized has contributed to this.

The volume of service in terms of hospital days has increased from less than three quarters of a million days in 1900 to over three and a half million days in 1938—a five-fold increase. This has been accompanied by a 50 per cent reduc-

tion in the average duration of care, due in large measure to an increase in the proportion of less severe cases. At present, one day of general hospital care is

TABLE 3

VOLUME OF HOSPITAL SERVICE, ONTARIO PUBLIC GENERAL HOSPITALS SELECTED YEARS, 1900-1938

| Year | Patients Treated | Patients per 1,000 Population | Patients per Bed | Total Days of Care | Days per Patient | Days per Caput |
|---|---|---|---|---|---|---|
| 1900 | 29,572 | 14 | ... | 723,455 | 24.5 | 0.32 |
| 1905 | 37,736 | 16 | ... | 757,624 | 20.1 | 0.33 |
| 1910 | 52,321 | 21 | 9.5 | 1,007,047 | 19.2 | 0.40 |
| 1915 | 82,690 | 30 | 11.6 | 1,466,206 | 17.7 | 0.54 |
| 1920 | 130,382 | 46 | 16.0 | 1,945,310 | 14.9 | 0.68 |
| 1925 | 152,102 | 49 | 15.2 | 2,130,305 | 14.0 | 0.68 |
| 1930 | 218,753 | 65 | 17.0 | 2,989,409 | 13.7 | 0.88 |
| 1935 | 246,562 | 67 | 17.8 | 3,294,763 | 13.4 | 0.90 |
| 1938 | 281,771 | 76 | 18.5 | 3,577,693 | 12.7 | 0.96 |

rendered annually for every person living in the province, a ratio three times that in 1900 (table 3).

*How Many Hospital Beds are Enough?*

This question cannot be answered directly. The needs of any community are dependent upon a multiplicity of factors among which are the attitude of the population toward hospitalization, the age composition of the population, nature of the occupations of people in the area, economic conditions, the extent of the available facilities, etc. It is suggested that a reserve of 25 per cent is adequate—five beds for every four patients.

Future needs are difficult to calculate because trends in hospitalization are uncertain. The provision of more convalescent and chronic disease accommodation and the extension of visiting nursing service in the homes would materially influence present requirements. Local needs, however, require a careful examination of local situations. The attitudes and customs of the medical profession, the presence of a teaching centre, the existence of hospitals in adjacent centres and the extent to which the urban centre hospitals give care to non-residents, all have a bearing on the situation. There is no justification for attempting to apply an arbitrary standard.

*Government Aid to Hospitals*

Since the establishment of the first hospital in this province in 1818, the responsibility for the public hospital costs of indigent patients has been borne jointly by the municipalities and the provincial government. Present government grants include municipal aid at $1.75 per diem and provincial aid (for 120 days) at 60 cents per diem. Both rates of aid have been revised upward—the municipal rate from $1.00 and the provincial rate from 20 cents—since 1912-17.

Increasing volume of state aid plus increasing hospitalization are two features of developments in Ontario. Provincial aid to public general hospitals in

1900 amounted to less than $100,000. In 1938 it reached about one and a quarter million dollars. Over the same period (1900 to 1938) the population increased by only 71 per cent. Up to 1907, the province's annual contribution amounted to less than 5 cents per person per year. In 1920 it reached 20 cents and now it is equivalent to over 30 cents per person per year. In terms of patient days, the province now pays 37 cents per day of care rendered, compared with 15 cents in 1900. Data for more recent years have suggested some improvement in the province's load of hospital costs but the burden is still significant, exceeding by a substantial margin the total expenditures on public health of the entire provincial health department.

Municipal expenditures are even more staggering. In 1900 they were less than $100,000 and now they exceed three million dollars—testimony to increasing hospitalization, increased per diem rates of aid to the hospitals, and a growing population. The volume of government aid is naturally sensitive to economic conditions and the funds paid to hospitals by the municipalities and the province rose both absolutely and in relation to total hospital income, during the depression period.

*Hospital Costs and Income—Trends and Distribution*

Operating costs (exclusive of depreciation) of public general hospitals have risen from half a million to twelve and a quarter million dollars since 1900. Costs per patient have risen substantially too, despite a 50 per cent reduction in average duration of care. This is the net effect of changes in the cost per patient day which was below $1.00 until 1905 and now is $3.70. Changes in more recent years have, however, been of a relatively small order (table 4).

TABLE 4

OPERATING COSTS, ONTARIO PUBLIC GENERAL HOSPITALS
SELECTED YEARS, 1900-1938

| Year | Operating Cost | Cost per Patient* | Cost per Patient Day* |
|---|---|---|---|
| 1900 | $ 549,063 | $18.95 | $0.77 |
| 1905 | 829,083 | 22.64 | 1.12 |
| 1910 | 1,265,217 | 25.17 | 1.30 |
| 1915 | 2,272,826 | 28.99 | 1.62 |
| 1920 | 5,849,223 | 48.17 | 3.16 |
| 1925 | 7,212,338 | 51.25 | 3.54 |
| 1930 | 10,937,237 | 54.76 | 3.94 |
| 1935 | 10,608,759 | 46.71 | 3.46 |
| 1938 | 12,263,473 | 47.59 | 3.70 |

*Infant days taken as one-quarter of adult values.

Studies here and elsewhere (3) have shown that the largest voluntary hospitals are the most expensive to operate despite the fact that this group has the highest bed occupancy. Furthermore, hospitals "with optimum facilities in any size-group cost more to operate than do those with average or minimum facilities." Professional and public recognition of the fact that differences in service—quality and extent—exist is apparent in the transfer of patients for treatment

to points far distant from their place of residence despite the existence of hospital facilities locally.

The income of public general hospitals is composed of four parts—income from municipalities, provincial government, patients, and from investments and donations. The trends in all components have been upward but important fluctuations have occurred in the percentage contributed by each during the past thirty-eight years (table 5).

TABLE 5

PER CENT DISTRIBUTION OF INCOME, SELECTED YEARS 1900-1938
ONTARIO PUBLIC GENERAL HOSPITALS

| Year | Patients | Municipal Grant | Provincial Grant | Investments and Donations | Total Income $1,000's |
|---|---|---|---|---|---|
| 1900 | 35.3 | 16.4 | 18.3 | 30.0 | 587 |
| 1905 | 48.6 | 18.4 | 12.7 | 20.3 | 815 |
| 1910 | 51.7 | 20.1 | 10.6 | 17.6 | 1,312 |
| 1915 | 51.2 | 30.0 | 7.9 | 10.9 | 2,389 |
| 1920 | 64.8 | 17.6 | 6.1 | 11.6 | 5,681 |
| 1925 | 64.3 | 16.9 | 9.0 | 9.8 | 7,113 |
| 1930 | 67.0 | 15.6 | 8.2 | 9.2 | 11,894 |
| 1935 | 54.3 | 27.4 | 12.0 | 7.4 | 11,621 |
| 1938 | 58.9 | 23.3 | 9.3 | 8.6 | 13,023 |

The percentage of the total income contributed by patients has tended to rise. The contribution made by the state has in recent years remained constant in relation to the total income, with the exception of the depression years when, coincident with a drop in patient revenue, there were substantial increases.

More than one-third of all provincial and municipal aid is paid to hospitals in Toronto alone. In 1938 this amounted to one and one half million dollars. Hospitals in Toronto, Ottawa, Hamilton, London, Kingston, and Windsor receive 60 per cent of all provincial aid and 72.5 per cent of all municipal grants—a total of $2,779,452 in 1938. These figures reflect the concentration of 53.4 per cent of all beds, 53.9 per cent of all patients and 58.6 per cent of all days of care in these centres as previously indicated (table 2).

*The Nature of Illness Requiring Hospitalization*

There are practically no Canadian data on the nature of the diseases and conditions responsible for hospitalization, their frequency and duration. A recent study of 60,743 consecutive discharges from all public general hospitals in Ontario, made by the Division of Medical Statistics of the Ontario Department of Health (2), makes possible for the first time the presentation of a tangible picture of the causes of hospital morbidity. The data cover a three-month period only.

The 60,743 patients studied had received a total of 824,525 days of care. A distribution of these cases according to general International List groupings, showing frequency and days of care, is presented in table 6.

Diseases of the digestive system, as a group, lead both in volume of cases and in days of care with 25.5 per cent of patients and 16.8 per cent of the total

TABLE 6

CAUSES OF HOSPITAL ILLNESS, INTERNATIONAL LIST GROUPS
DISCHARGES AND DEATHS, ONTARIO

| Diagnosis Class | Per Cent Patients | Per Cent Days |
|---|---|---|
| Diseases of Digestive System* | 25.5 | 16.8 |
| Pregnancy and Childbirth | 14.8 | 11.9 |
| Conditions of Early Infancy† | 11.5 | 9.8 |
| Injuries and Accidents | 10.0 | 10.5 |
| Diseases of Genito-urinary System | 6.5 | 7.2 |
| Diseases of Respiratory System | 5.2 | 4.9 |
| Cancer and Other Tumours | 4.9 | 7.5 |
| Diseases of Nervous System | 4.3 | 6.0 |
| Diseases of Circulatory System | 3.4 | 7.0 |
| Rheumatic and General Diseases | 2.8 | 5.2 |
| Other Specified Groups | 7.7 | 11.0 |
| Others, Unspecified | 3.5 | 2.2 |
| Total | 100.0 | 100.0 |
| Actual Numbers | 60,743 | 824,525 |

*Includes diseases of tonsils and adenoids. †Includes newborn.

days. Diseases and conditions of pregnancy and childbearing rank second while accidents and injuries place third in order of importance, with 10 per cent of cases and 10.5 per cent of all days of care.

Some idea of the relative importance of those conditions principally responsible for hospitalization can be obtained from a review of the chief entities reported in the group surveyed. In table 7 data are given on the frequency and days of care for the ten items of greatest frequency.

Of all cases, 46.5 per cent fell into these ten groups and these were respon-

TABLE 7

THE CHIEF CAUSES OF HOSPITAL ILLNESSES, SURVEY DATA*
DISCHARGES AND DEATHS, ONTARIO

| Diagnosis | Patients | | Days | |
|---|---|---|---|---|
| | Number | Per Cent | Number | Per Cent |
| 1. Deliveries, Uncomplicated | 6,857 | 11.3 | 79,794 | 9.7 |
| 2. Newborn Infants | 6,741 | 11.1 | 75,065 | 9.2 |
| 3. Appendicitis | 4,223 | 7.0 | 55,561 | 6.7 |
| 4. Fractures | 2,493 | 4.1 | 51,563 | 6.3 |
| 5. Wounds | 1,754 | 2.9 | 13,420 | 1.6 |
| 6. Cancer (all forms) | 1,608 | 2.6 | 42,339 | 5.1 |
| 7. Diseases of Heart and Arteries | 1,369 | 2.3 | 41,754 | 5.1 |
| 8. Abortion | 1,167 | 1.9 | 9,467 | 1.1 |
| 9. Pneumonia and Bronchitis | 1,137 | 1.9 | 22,719 | 2.8 |
| 10. Hernia | 861 | 1.4 | 15,737 | 1.9 |
| Total of 1-10 | 28,210 | 46.5 | 408,467 | 49.1 |
| Grand Total | 60,743 | 100.0 | 824,525 | 100.0 |

*Diseases of tonsils and adenoids excluded. These cases numbered 6,983 (11.5 per cent of the total) and contributed 1.5 per cent of all days of care.

sible for 49.1 per cent of all days of care. The volume of appendicitis is striking: on an annual basis, the findings suggest as many as 16,000 cases per year. It is responsible for more hospital cases than cancer, pneumonia, diarrhoea and enteritis, and diabetes, combined. The frequency of abortion is noteworthy, the figures indicating over 4,000 hospitalized cases annually. The staggering morbidity due to accidents is emphasized by the position of fractures and wounds in the list of chief causes.

In terms of days of hospital care, the relationship of the first ten items in importance is also shown in table 7. The volume of care necessitated by accidents is remarkable, exceeding that for pneumonia, diabetes, abortion, and diarrhoea and enteritis combined. The importance of arthritis (not shown in table 7) as a cause of hospitalization is out of all proportion to its frequency, 405 patients contributing 14,059 days of care. Fractures and wounds contributed about 8 per cent of all hospital days among the group surveyed.

*The Hospital Clientele—Indigent vs. Pay-patient Experience*

The patient population treated in Ontario public general hospitals may be distributed in a series of categories according to method of payment of maintenance. During 1938, of all adult patients 55.7 per cent were private and semi-private and 13.6 per cent were self-pay ward patients. In contrast, 26.4 per cent were municipal indigents to whom municipal aid would be extended. Of all days of care, 42.8 per cent were rendered to private and semi-private patients, 40.5 per cent to municipal indigents, and 12.1 per cent to self-pay ward patients. The balance of patients and days of care is made up of provincial indigents, transients, etc.

Provincial aid was applicable to 43 per cent of all patients and to 56 per cent of all days of care, during the year. Of the whole adult patient population, *almost 28 per cent were unable to pay anything toward the cost of their hospital care.* This group of patients evidently plays a disproportionately large part in hospitalization since it contributed *42.8 per cent of all hospital days during the year.*

Not only is the proportion of indigent cases and hospital days high in relation to the total hospitalization, but there are rather substantial differences between the duration of care among indigents compared with pay patients. These differences in the gross to-day represent many tens of thousands of dollars additional expenditure by state and local government authorities. Studies made of the average duration of care by age show further that there are marked excesses among indigents compared with pay patients in every age group and that the average duration of care increases steadily with age.

While differences in the proportion of illnesses of various types within the several age groups in pay patients alone could make the averages for these patients lower than those for indigents, evidence shows that the indigent excesses persist even for individual diagnoses and specified age groups (table 8).

The differences are substantial in each instance, so that age, sex or diagnosis alone do not account for them. Indigents stay longer in hospital under apparently identical *physical* circumstances. Further data are given in table 9.

TABLE 8

AVERAGE LENGTH OF HOSPITAL STAY BY AGE CERTAIN DIAGNOSES

| Diagnoses | Age | Self-Pay Ward | Municipal Indigents | Private and Semi-private |
|---|---|---|---|---|
| Appendicitis (Males) | 1-9 | 10.8 | 17.3 | 7.7 |
| | 10-19 | 12.2 | 16.9 | 10.3 |
| Peptic Ulcer (Males) | 20-39 | 13.2 | 27.4 | 15.7 |
| | 40-59 | 14.1 | 27.5 | 12.7 |
| Deliveries | 20-39 | 11.0 | 13.1 | 11.3 |
| | 40-59 | 10.7 | 15.2 | 12.5 |

TABLE 9

AVERAGE DURATIONS OF CARE, SELECTED DIAGNOSES, ALL AGES ONTARIO PUBLIC GENERAL HOSPITALS

| Diagnoses | Self-Pay Ward | Municipal Indigents | Private and Semi-private |
|---|---|---|---|
| Chronic Tonsillitis | 2.0 | 2.9 | 2.0 |
| Appendicitis, Acute | 11.8 | 15.7 | 11.2 |
| Appendicitis, Chronic | 10.9 | 16.6 | 12.0 |
| Hernia, Inguinal | 15.9 | 20.9 | 14.6 |
| Abortion, Incomplete | 7.3 | 10.5 | 6.0 |
| Otitis Media | 9.4 | 17.0 | 7.1 |
| Neurasthenia | 7.3 | 19.2 | 7.4 |
| Retroversion of Uterus | 14.5 | 17.0 | 14.0 |

The differences in separate entities are consistently substantial and the situation clearly demands reflection, whether judged from the viewpoint of the provincial and municipal government authorities or from the viewpoint of the health and social welfare status of the patients involved.

*Chronic Disease*

How great a part does chronic disease play in the present hospitalization problem? Including arbitrarily as chronic diseases—chronic arthritis, diseases of the heart and circulatory system, arteriosclerosis, nephritis, cancer and other tumours, diabetes, asthma, tuberculosis, ulcer of stomach, diseases of gall bladder and nervous diseases, osteomyelitis, deformities and the like, it is found that these account for at least 26 per cent of the patients discharged and for 41 per cent of the days. Among pay-public patients the proportion of all patients and days due to chronic diseases is much less than that in indigents; viz., 22 and 34 per cent compared with 32 and 51 per cent.

The part played by chronic disease is a large one and further studies in future promise much in orienting us properly in respect to it. Future developments in relation to the treatment and hospital care of certain groups of chronic cases should be based on accurate appraisal of the situation as it exists.

*What Does the Future Hold?*

The population of this province has doubled since 1881. Future hospital

needs depend in large measure upon population changes—changes not only in numbers, but in structure. On the basis of present birth and death rates, it is estimated that the population will increase by half a million in the next ten years, and reach 4,676,000 by 1961.

The sickness and death experience of any population and the health services required are dependent to an important degree upon the relative proportions of the various age groups therein. Ontario has been experiencing substantial changes in this respect—a decline in the proportion of persons at ages under 30 years and an increase above this level. At ages 60 and over the trend is much more marked. Table 10 indicates the changes in the proportion of persons at certain ages at census periods from 1880-1931 with estimates to 1961.

TABLE 10

DISTRIBUTION OF ONTARIO POPULATION BY AGE
1881-1961

| Year | Total Population (thousands) | Per Cent Under 40 | Per Cent 40-59 | 60 and over | |
|---|---|---|---|---|---|
| | | | | Number | Per cent |
| 1881 | 1,927 | 79.28 | 14.56 | 118,700 | 6.16 |
| 1891 | 2,114 | 77.27 | 15.54 | 152,019 | 7.19 |
| 1901 | 2,183 | 73.70 | 17.91 | 183,220 | 8.39 |
| 1911 | 2,527 | 72.24 | 19.26 | 214,932 | 8.50 |
| 1921 | 2,934 | 70.32 | 20.51 | 269,133 | 9.17 |
| 1931 | 3,432 | 67.99 | 21.84 | 349,108 | 10.17 |
| 1941 | 3,848 | 64.83 | 23.39 | 453,142 | 11.78 |
| 1951 | 4,301 | 63.68 | 22.93 | 576,046 | 13.39 |
| 1961 | 4,676 | 62.62 | 23.06 | 669,480 | 14.32 |

In 1931 there were twice as many persons 60 years and over in Ontario, as in 1901. By 1961 this number may again double itself, so that one person in every 7 or 8 may be 60 years of age or over. These changes are very important to anyone inclined to take the long view, because age per se has a marked influence upon the need for both hospital and domiciliary medical care. A few illustrations will serve to make this clear.

At ages under 50 years marked improvements have been registered in the health of the population during the past 30 years. At ages 50 and over, no comparable improvement is evident. In addition, mortality statistics show that whereas in 1907, 40 per cent of all deaths occurred at ages 50 and over, in 1937 almost 70 per cent were at these ages. This is further evidence that the *proportion* of the total medical and hospital care which is needed by persons at older ages will continue to increase in importance.

Both morbidity and mortality increase steadily with age. In general sickness the increase begins at about 20-24 years of age; in mortality it begins after 10-14 years. Not only does the risk of illness and death increase with age, but the duration of sickness or incapacity likewise increases markedly. Table 11 gives some data on the frequency and duration of hospital care from recent Ontario studies. Data for males only are shown.

Both the frequency and duration of hospital care at ages 60 and over are

TABLE 11

HOSPITAL MORBIDITY BY AGE, MALES
DISCHARGES AND DEATHS, ONTARIO PUBLIC GENERAL HOSPITALS

| Age | Rates per 1,000 Population‡ | | Days per Patient |
|---|---|---|---|
| | Cases | Days | |
| Under 1* | 94 | 1,740 | 18.5 |
| 1 - 9 | 42 | 388 | 9.2 |
| 10-19 | 33 | 392 | 12.0 |
| 20-29 | 51 | 556 | 10.9 |
| 30-39 | 48 | 644 | 13.5 |
| 40-49 | 46 | 720 | 15.7 |
| 50-59 | 52 | 947 | 18.1 |
| 60-69 | 60 | 1,492 | 25.0 |
| 70-79 | 74 | 1,976 | 26.8 |
| 80 and over | 83 | 2,296 | 27.6 |
| All Ages | 48 | 720 | 14.8 |

*Newborn excluded. ‡Rate per 1,000 population (annual).

substantially greater than at younger ages. The figures for females are basically similar, although women use more hospital care than men. The adult female frequency (cases per 1,000 population per annum) is 71 compared with 48 in males or almost 50 per cent higher. The volume of care in females also exceeds that in males, being 0.94 days per person compared with 0.72 days in males, or 30 per cent higher. The female excesses are largely due to or associated with diseases peculiar to women, principally pregnancy, childbearing and the puerperal state (4).

## COMMENT

If the population forecast previously made is even reasonably accurate, a substantially greater demand for hospital care from the older age fraction of the population is to be anticipated. This involves also an increased demand for medical service in general and possibly greater burdens for government authorities. These presumed demands are both related to an increase in chronic disease cases.

Except in so far as the development of specialized institutions for the care of patients with chronic disease is concerned, there is no justification for presuming a need for indiscriminate extension of hospital facilities. We already have 4 beds per 1,000 population—the average utilization of which, except in a few instances, is rather low.

In considering future hospitalization needs, careful attention should be paid to trends in population structure and to the several facts presented, including local situations. Statisticians five years ago foretold empty public school classrooms. Future hospital needs will be influenced and subject to adjustment by trends, the direction of which can in large measure be ascertained now.

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# Laboratory Procedures in Staphylococcal Food Poisoning

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SINCE the staphylococcus is being more widely recognized as the etiological agent in the type of food poisoning characterized by rapid onset of acute vomiting and diarrhoea with prompt and complete recovery, it becomes necessary that public health laboratories have available a ready method of identifying the causative micro-organism, and of tracing the source of contamination. The incrimination of the staphylococcus in past outbreaks reported in the literature has been based principally upon reproduction of the characteristic syndrome by feeding human volunteers filtrates prepared from the strains isolated from suspected foods. While this is fundamentally the most convincing method of demonstrating the presence of a gastro-intestinal poison* in foods or filtrates in which certain strains of staphylococci have grown, it presents difficulties that render it unsuitable as a test in any extensive research. Further, the classification of staphylococci by cultural or biochemical characteristics alone is for the most part of little value in investigating outbreaks of food poisoning. Hence an attempt has been made to develop methods whereby the identity of individual strains may be readily established and their toxigenic properties ascertained.

The widespread occurrence of staphylococci invalidates the incrimination of the micro-organism by mere isolation from suspected food. Filtrates prepared from the culture must be shown to contain the food-poisoning principle. Indeed, several strains may be present in heavily contaminated food, and unless some method of readily distinguishing one from another be available, erroneous data will be obtained in subsequent investigations; for although their chromogenicity and cultural appearance may be identical, their toxigenic properties may differ widely. In an epidemiological investigation to determine the original source of contamination one must be able to demonstrate the fact that the strain found in the food is identical in all of its characteristics with one selected from among many that may be isolated from noses and throats or superficial lesions of the bakery employees, from raw food products, and from bakery utensils. The methods to be outlined are recommended as useful and relatively simple procedures, and were developed and used in the investigations reported by Roberts, Deadman, Elliott and Wilson (1938) in Canada.

While carbohydrate utilization, chromogenicity and agglutinative characteristics serve as some measure of broad classification of staphylococci, these are for the most part unsatisfactory criteria for strain identification. With

**Dolman, Wilson and Cockcroft (1936) have pointed out that the so-called enterotoxin of staphylococcus cannot be regarded as a direct gastro-intestinal irritant.*

the increase in knowledge of the toxigenic properties of certain strains of this micro-organism, it has been found that the toxic constituents of the filtrates of any given strain are fairly characteristic and reasonably constant in potency under favourable conditions of growth. It is proposed therefore that the toxigenic properties, both qualitative and quantitative, be utilized in the identification of individual strains of staphylococci.

Of the many toxic properties of staphylococcal filtrates that have been reported, some of the most readily assayed are the $\alpha$ hemolysin (rabbit erythrocyte lysin), $\beta$ hemolysin (sheep erythrocyte lysin), the enterotoxin or food-poisoning substance, and the Lh dose, or the amount of filtrate required to neutralize 1.0 standard unit of staphylococcus antitoxin (Hartley and Llewellyn Smith, 1935). The values obtained from these four tests may be used to compare and to establish the identity of strains of staphylococci under examination.

While the rather rapid onset of projectile vomiting following the consumption of contaminated food is particularly characteristic of staphylococcal food-poisoning, care must be taken to exclude the possibility of salmonella infection. Furthermore, the streptococcus, colon bacillus, and others have been reported as etiological agents in past outbreaks, and all of these must be given due consideration if the staphylococcus is not found to be the predominating micro-organism.

The isolation of staphylococci from infected food is greatly facilitated by the use of 10 per cent sheep blood agar plates. Portions of the food are emulsified in broth, and a loopful of the supernatant is streaked directly on the plates. The inoculated broth is allowed to incubate for 24 hours before plating. The plates must be spread sparingly in order to obtain widely separated single colonies. If the culture be hemolytic, colonies of staphylococci may be readily detected in the presence of large numbers of other contaminating micro-organisms; and if more than one strain of staphylococcus be present, they may be distinguished by differences in the character and extent of the zone of hemolysis surrounding the colonies. Marked differences in chromogenicity may also be used in detecting the presence of more than one strain, but too much emphasis should not be placed on slight differences in colour.

Toxic filtrates of strains under examination are prepared according to the method outlined by Dolman and Wilson (1938). Identification and measurement of the toxic constituents of filtrates so prepared provide the basis for strain identification.

The hemolytic titres are obtained by making serial dilutions of the toxic filtrate in physiological saline, adding washed rabbit or sheep erythrocytes to give a 1.0 per cent suspension, and incubating in a 37° C. water bath for one hour. The $\alpha$ hemolytic titre is read after 1 hour at 37° C., and the $\beta$ hemolytic titre is read after a further hour's standing at room or refrigerator temperature. The end-point is taken as the last tube showing 50 per cent hemolysis.

The Lh dose determination is made according to the method of Hartley and Llewellyn Smith (1935) and the presence of the enterotoxin is demonstrated by the kitten test (Dolman, Wilson and Cockcroft, 1936; Dolman and Wilson,

1938). The data from these four tests are frequently sufficient to identify strains isolated from the food samples as similar to one or more strains isolated from persons, food products or utensils suspected as the primary source of contamination. Table 1 shows the type of data obtained during the examination of strains isolated from incriminated foods, and from the noses and throats of bakery employees following a recent outbreak in Canada (Roberts, Deadman, Elliott and Wilson, 1939).

TABLE 1

STRAINS OF STAPHYLOCOCCI ISOLATED DURING THE INVESTIGATION OF AN OUTBREAK OF STAPHYLOCOCCAL FOOD-POISONING IN HAMILTON, CANADA, MARCH 1939

| No. | Patient | Source | Hemolysis on Blood Plate | Colour | Hemolytic Titres $\alpha$ | $\beta$ | Lh Dose | Kitten Test |
|---|---|---|---|---|---|---|---|---|
| 970 | From church | Pie | Wide primary | Aureus | 4096 | 512 | 0.05 cc. | + |
| 971 | From home H. | Pie | Wide primary | Aureus | 4096 | 512 | 0.05 cc. | + |
| 975 | Miss F. | Throat | Wide primary | Aureus | 2048 | 128 | 0.12 cc. | 0 |
| 976 | Mr. R. G. | Nose | Wide primary | Aureus | 1024 | 128 | 0.12 cc. | 0 |
| 977 | Mr. R. G. | Throat | Non-hemolytic | Albus | — | — | — | |
| 981 | Miss W. | Throat | Non-hemolytic | Albus | — | — | — | |
| 982(*a*) | Miss J. | Nose | Wide primary | Aureus | 4096 | 512 | 0.06 cc. | + |
| 982(*b*) | Miss J. | Nose | Non-hemolytic | Albus | — | — | — | |
| 983(*a*) | Miss J. | Throat | Wide primary | Aureus | 4096 | 512 | 0.06 cc. | + |
| 983(*b*) | Miss J. | Throat | Non-hemolytic | Albus | — | — | — | |
| *1234 | Miss J. | Nose | Wide primary | Aureus | 4096 | 512 | 0.06 cc. | + |

*Strain 1234 was isolated from Miss J.'s nose 1 week after the outbreak.

Cultures 970 and 971 were obtained from two places supplied by the same bakery, and show marked similarity in all of their hemolytic characteristics. Of those obtained from employees working in the bakery, nos. 977, 981, 982(*b*) and 983(*b*) can be excluded, since they show no hemolytic characteristics resembling those obtained from the pies, nor are they similar in colour. Cultures 975 and 976, after several filtrates had been prepared and tested, showed lower toxigenic potency than cultures 970, 971, 982(*a*) and 983(*a*), and in determining the Lh dose, the end-point of hemolysis was consistently indistinct, in marked contrast to the sharp end-point shown by the latter four filtrates. It may be seen that nos. 982 and 983 are from the nose and throat, respectively, of the same person; and it was found that she was in charge of the preparation of the filling used in the pies.

The stability of these toxigenic characteristics is first shown in table 1 by strain 1234 which was isolated from the throat of Miss J. a week or so after the outbreak. There is no demonstrable difference between the properties of this culture and those of the cultures isolated at the time of the outbreak. Much more convincing evidence of this stability is shown in table 2, in which are given the toxigenic characteristics of strains isolated over a period of a year from a person incriminated as the source of infection in two previous outbreaks (Roberts, Deadman, Elliott and Wilson, 1938).

On the basis of these findings, Mr. W. R. S. has been incriminated as a

TABLE 2

STRAINS OF STAPHYLOCOCCI ISOLATED FROM PASTRY AND UTENSILS DURING THE INVESTIGATION OF TWO OUTBREAKS OF STAPHYLOCOCCAL FOOD-POISONING ORIGINATING IN THE SAME BAKERY IN HAMILTON, CANADA, MARCH AND MAY, 1938, AND FROM THE NOSE AND THROAT OF THE OWNER OF THE BAKERY FROM MARCH 1938 TO APRIL 1939

| No. | Patient | Source | Date | Hemolysis on Blood Plate | Colour | Hemolytic Titres α | Hemolytic Titres β | Lh Dose | Kittens Test |
|---|---|---|---|---|---|---|---|---|---|
| 456 | Family 1 | Pie | 10.3.38 | Wide primary | Aureus | 1024 | 256 | 0.05 cc. | + |
| 457 | Family 2 | Pie | 10.3.38 | " " | " | 1024 | 256 | 0.05 cc. | + |
| 516 | Bakery | Pastry Bag | 10.3.38 | " " | " | 1024 | 256 | 0.05 cc. | + |
| 489 | W. R. S. | Throat | 10.3.38 | " " | " | 1024 | 256 | 0.05 cc. | + |
| 717 | W. R. S. | Nose | 2.4.38 | " " | " | 1024 | 256 | 0.05 cc. | + |
| *1162 | Bakery | Vanilla Slice | 1.6.38 | " " | " | 2048 | 256 | 0.05 cc. | + |
| 1545 | W. R. S. | Nose | 20.7.38 | " " | " | 2048 | 256 | 0.07 cc. | + |
| 1043-2 | W. R. S. | Nose | 2.4.39 | " " | " | 1024 | 256 | 0.05 cc. | + |

*Strain 1162 was isolated from a vanilla slice that was incriminated in a second outbreak originating in the same bakery, six weeks after the first outbreak.

carrier. He has evidently harbored the micro-organism for over one year, and in that period the toxigenic characteristics of the strain have not changed. The strain Barrs, used by Dolman and Wilson (1938) in their experiments on staphylococcal enterotoxin, was isolated several times over a period of four years from the nasal mucosa of the same individual; and the toxigenic properties of the strain, when freshly isolated, were on each occasion remarkably similar.

The use of the kitten in testing for the presence of the food-poisoning substance, first reported by Dolman, Wilson and Cockcroft (1936), has met with success in the hands of workers in several laboratories. Kupchick (1937) and Minett (1938) reported extensive research on the nature of the food-poisoning substance, and in identifying strains of staphylococci incriminated in various outbreaks. In these experiments the kitten was used as a test animal, and their findings agreed with those of Dolman *et al.*

The separation of the enterotoxin from the lethal, necrotic and lytic toxins of staphylococcus may be effected in several ways. (*a*) The addition of 0.3 per cent formalin (U.S.P.) and incubation at 37° C. for several days inactivates the latter substances but leaves the enterotoxin intact. The formalized filtrates are tested daily until they fail to hemolyze erythrocytes of rabbits and sheep. (*b*) Boiling the filtrates for 20-30 minutes effectively destroys the lethal, lytic and necrotic toxins contained in the filtrates, but the enterotoxin, which is relatively heat-stable, is not affected by this treatment. The latter method was used successfully by Kupchick (1937) and Minett (1938) in their experimental work. (*c*) Since all hemolytic filtrates do not contain enterotoxin, it has been possible to obtain an antitoxin that selectively neutralizes the hemolysins, and the lethal and dermonecrotic principles (Dolman and Wilson, 1938). The last method has been used for the most part in our laboratories. There is little to choose between these three methods except in the

ease and rapidity with which the desired effect is obtained. All three render the filtrate suitable for parenteral injection without destroying the food-poisoning principle.

It is not proposed to discuss the specificity of the kitten test for the enterotoxic substance, which appears to have been satisfactorily established, but one or two comments on the technique of the test are perhaps relevant. In no instance in our laboratory, nor in those of Kupchick (1937) and Minett (1938), has a kitten been found refractory to the food-poisoning substance. Certain conditions must be fulfilled in order to ensure a satisfactory test. Firstly, it has been found that animals should not receive solid food within one hour of the injection. Regurgitation is not uncommon in normal cats for some little time following a meal of fluid consistency, and in observations by inexperienced workers this has been mistaken in the past for a positive reaction. Secondly, the injected fluid should be brought to body temperature and injected intraperitoneally, carefully and slowly, to avoid vomiting and defecation of reflex nature arising from physical stimulation. Although we have little evidence in many hundreds of injections in this laboratory that such stimulation will produce the projectile type of vomiting characteristic of the food-poisoning syndrome, some discomfort might result, and Minett (1938) records some exceptional instances in which vomiting of apparently reflex nature occurred immediately following inoculation. This occurrence is rare, however, and is apparently not followed by repeated bouts of vomiting. In those instances where little or no vomiting occurs, but there is evidence of definite distress followed by diarrhoea, the test is repeated with larger doses, up to 5.0-6.0 cc., until the characteristic syndrome is produced.

It may be well to mention in conclusion, some of the difficulties encountered in the laboratory investigations of staphylococcal food-poisoning. One point that cannot be overemphasized is the extreme importance of adequate and immediate epidemiological investigation in the field. Many outbreaks cannot be investigated because of lack of food samples, case histories, and an insufficient number of cultures from noses and throats of employees, raw food products and utensils. The transient nature of this type of poisoning frequently tends to cause laxity on the part of those investigating the outbreak.

In some instances, no etiological agent can be found in the food although the case histories throw suspicion on staphylococcus. It is possible in such cases that the food has been cooked subsequent to the growth of staphylococci in one of the raw products. Minett (1938) has shown that extracts of foods contaminated by staphylococci will give a positive reaction in kittens, so that under such circumstances direct injection of food extracts may be used as a diagnostic measure.

In comparing the toxigenic properties of a number of strains it is desirable to prepare all of the filtrates at the one time on the same batch of medium, and to incubate them in the same anaerobic jar into which the atmosphere of carbon dioxide and oxygen is introduced. Failing this, one of the previously isolated strains should be included each time for comparison. Although under the conditions described, toxin production is fairly constant, variations do

occur, and unless the foregoing precautions be taken, these variations may be sufficient to confuse the interpretation of the findings.

One of the chief difficulties encountered is the maintenance of a supply of kittens. Several laboratories are in unanimous agreement that cat colonies are not easily maintained. Hammon and Enders (1939) have claimed that the principal cause of death is an infection caused by a virus, and their experimental findings are almost identical with the experience that we have had with our cat colonies in the past few years. It has been found that it is most desirable to obtain kittens only as required, and to dispose of them as quickly as the experiment permits. Kittens, if they recover from the effects of the first injection, may be used again within 10 to 12 days, for Dolman and Wilson (1938) have shown that no apparent active immunity is acquired within the first three weeks following injection of toxic filtrates.

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# Noise and Vibration Control

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NOISE, along with many other social evils thrust upon us by the complexity of modern urban life and accepted with resignation as a necessary concomitant of a highly industrialized society, has at last been given recognition as a genuine social evil, and that the task of its abatement is not a hopeless one has been demonstrated by the activities of the Noise Abatement Commission of New York City.

Centralization of traffic and industry in cities has so intensified the destructive effects of vibration and noise as to constitute these conditions a major engineering problem. Various circumstances interact to bring this about. Transit development, as well as growing street traffic, brings a rapid and continual increase in the sources of vibration and noise. Increased traffic facilities are accompanied by increased height of buildings, and since the susceptibility to vibration of steel or concrete structures increases with their height, the effects of vibration are intensified. Modern business conditions increase human susceptibility, moreover, so that vibration and noise become a menace to health.

It has been estimated that 80 per cent of the noise in all districts except industrial ones is caused by traffic. An investigation tends to show that it is the interrupting and loud noises that irritate and perturb.

The noise problem is serious, as noise breeds noise. Loud traffic noises require loud warning signals. This increases the din and in turn calls for louder warning signals. Note, for instance, the sirens in use by the Police and Fire Departments at the present time. A few years ago a warning gong was all that was necessary and it could be heard for blocks.

Noise in industry is due to the running of machinery and to actions effected by machines; to vibration and din caused by parts of machines that are not well equilibrated; to transmission gear, such as defective driving belts or bad running; to such tools as hammers and saws; and to the manipulation and transport of material.

The noisy trades have been classified as follows:

*Metallurgical trades.* Smelting and casting, especially fettling and removing sand by means of pneumatic hammers; mechanical stamping by steam hammers; rolling, beating and drawing metals; and forge work. But the noisiest work of all is riveting, either by hand or mechanically. In this latter case the hammer may be rigid or movable, and either held in the hand or fixed on a rest. Automatic riveting may be carried out by means of compressed air, steam, or electric power. A different technique, wherein hydraulic pressure takes the place of the blow, is noiseless. The unpleasant conditions that accompany riveting vary according to the method employed, depending on the workman's position, and

on augmentation of noise by resonance, according as the work is carried on in the open air or not, in workshops or even inside boilers, reservoirs, and gasometers that are being riveted. The mechanical cleaning of boilers by means of pneumatic picks, delivering 6,000 blows a minute, is also very trying work. The cutting, milling, planing, boring, and drilling of metals, all of which make discordant sounds, must also be classed among noisy operations. The polishing of metals and soldering operations, especially with the electric arc, make a shrill whistling noise; the gas blow-pipe makes more rasping sounds.

*Textile industries:* Weaving and spinning. In flax spinning the noisiest operations are those of preparation and spinning; mechanical combing and carding are less noisy; bleaching of cotton is very noisy. In the garment-making industries the sewing machine is an extremely noisy factor.

*Felt industry:* The mechanical processes of pulling out and scraping the hair, and also hair clipping, are very noisy.

*Transport industries:* Especially railways. Workers in the workshops, mechanics, stokers, and engine-drivers are all exposed to the din and whistling of the trains, and also to noises from oil engines (Mazout), from which the hum of the combustion is far louder than from coal-driven engines.

*Building trade:* Noisy operations are stone-breaking, construction of tunnels, breaking down walls and foundations by use of pneumatic picks, and work on building stone with stone saws.

Other noisy industries are: the *manufacture of cement*, of earthenware, of refractory goods, of porcelain, and of emery wheels; the *wood industry* including sawing, smoothing and planing; *flour mills, chemical industries*; extraction of oil by pressure; *manufacture of india-rubber goods; multigraphing processes*, especially those connected with rapid printing presses; *telephone work*, from the crackling noises in the instrument; *telegraphy*, from the noise caused by the apparatus and the operators; *gunpowder and armament industry*: while testing firearms, manufacturing rifles, and tending shooting ranges.

Apart from these various sources of noise, must be noted, in all industries and in every place, dull noise and vibration of the ground and walls, due to machinery in rapid motion, such as dynamos, motors, and driving belts; and, above all, worn cog wheels. Increase in these noises is due partly to the development of machinery, and also to the fact that modern concrete buildings are first-rate conductors of sound.

All the workmen employed, say, in copper works, iron works, or a big ship-building yard are not exposed to an equal degree to the noises peculiar to the industry. The differences may amount to a slight effect, or to double, ten-fold, or a hundred-fold effect, and this may go on for years. Besides, in some workshops the noise may be deafening in some places, but quite bearable elsewhere, e.g. in stamping out metal and in factories for stamped metal boxes. The degree of noise so varies according to the machinery that in workshops which are essentially vibrating and noisy, there may be, as a matter of fact, corners which are tolerably quiet. In boiler making, for instance, those who are most exposed to noise are the young apprentices who help the riveters by holding up rivets from inside the boilers, whilst they are being hammered home. The same applies to

boiler-scrapers, young boys who go inside boilers in works and on ships to remove the scale.

It is also necessary to mention shops and modern offices. The latter are specially noisy; this is due to several causes: the cost of modern buildings, which makes it necessary to economize as far as possible in space; and new methods of organization which tend to create a modern central office instead of an office for each department. The number of office machines goes on increasing; there are machines for typing, calculating, binding, classifying, multiplying copies, and addressing. As in the case of factories, modern buildings are hard and fireproof, and are built of concrete in such a way that they do not absorb sounds, which is accentuated by the fact that there are rarely any curtains, hangings, or carpets to deaden the sound. Then again offices may be situated in noisy streets, quiet one day and busy the next. In summer there is the additional complication offered by open windows.

Noises act by intensity, pitch and tone. The most intense are the most injurious. Some authorities consider the pitch to be the important element. The din in boiler-making works is more injurious than the roaring in cotton-spinning mills; the report of small calibre artillery and machine guns is more injurious than the booms of big guns (Cheatle). The pitch is more difficult to estimate than the intensity; but it may be estimated by comparison with sounds of a known pitch.

Tone in combination with pitch gives to certain noises the particularly disagreeable character which distinguishes them, such as the rasping and rattling sound of flints or the grating of saws or files. Tone may easily be distinguished with considerable accuracy. It is tone which makes it possible to pick out different machines in motion without seeing them.

To these fundamental characteristics of noises must be added other harmful factors. First there is the time that the sounds last—the exposure to noises; the noises that last the longest are said to be the most harmful to the workers exposed to them.

Rhythm is also an important factor in the harmful nature of an industrial noise. Noises that vary in intensity and are uncertain and irregular as to the moment of their production are more harmful than constant, humming sounds to which one may learn to get accustomed.

Account must also be taken of resonance and the reflection of noise. Resonance may vary according to the position of the workmen in relation to the noise. Work within closed walls is more injurious than work in the open air. Thus hammering inside a boiler, the resonance of enclosed workshops where engines are built, or firing from warships or in enclosed rifle ranges are all very dangerous.

Apart from the resonance, it is necessary to ascertain whether vibrations are mingled with the actual noise.

The influence of noises on the health of workers presents an important problem, for it concerns nearly every modern industry. As a matter of fact, there are few industries to which the introduction of machinery has not brought, in addition to radical changes in methods of work, more or less serious disad-

vantages from noise and vibration. The study of industrial noises is of comparatively recent date, and the increasing interest which it arouses is accounted for partly by the increase in industrial noises, and partly by a better realization of their harmful effect, and of the waste of energy which they cause.

Noises consist of a more or less rapid succession of sounds, irregular in periodicity and in intensity. Sound properly so called is, on the contrary, uniform, steady and without variations in its constituent parts. It is an accepted fact that all noises may be referred to pure musical sounds; for they are similarly constituted with regard to intensity, pitch and tone.

In industry there are met with:

(1) Musical sounds properly so called, e.g. in industries where sonorous metals are beaten, as when copper boilers and other copper ware articles are wrought. However, more or less pure sounds rarely occur alone.

(2) Noises properly so called.

(3) Tremors of varying intensity, affecting the ground and the bodies of workers, due to the vibration of machinery. Although these tremors are sometimes accompanied by the production of fairly loud noises, these noises cannot as a rule be regarded as excessive. Besides, it is often difficult to decide at what point noise ceases and vibration begins. The decisive factor is the number of sound waves per second, and it is difficult to decide if it is the ear by itself, or the whole body which detects the sound or vibration.

Vibrations are generally originated by out-of-balance conditions, by impacts, and in many cases also by rotating machinery which may be considered commercially balanced but which causes transmission of noise and vibration.

Vibrations from machines may be deadened by arranging them on bases of special materials or on special foundations, independent of the floor used by the personnel, or enclosing them in special rooms closed by stout iron doors. The same considerations in offices and business premises lead to placing typists and other machine operators in separate rooms.

Modern industry now generally recognizes machinery vibration transmission as a source of loss that cannot be tolerated under present conditions of keen competition. Actually vibration is just as much a problem to machinery owners and operators as incorrect lubrication so far as operating and maintaining costs are concerned.

Measures applicable to work can only be arranged after careful examination of the surrounding conditions, and aim at protection against noises by isolating or deadening them. First of all, it is advisable only to allow noisy works to be set up in neighbourhoods where they will not be a nuisance, so that work can be carried on in the open air or with open windows. The same considerations should lead to the choice, for the situation of offices, of quiet streets or at the top of high buildings. Again, it would be advisable to prohibit noisy work in buildings of several floors.

Walls, ceilings and especially floors can be covered with anti-noise materials which diminish the production of vibrations from the ground. With this object, there may be used felt made of leather, hair, asbestos, or wood pulp, which can be made fireproof in some cases by silicate of soda or india-rubber, while, for

the floors particularly, linoleum, or numerous special compounds now on the market, and special plasters are used.

In recent years great progress has been made in the field of sound control. Certain types of window ventilators will reduce the amount of noise that enters through them; walls, ceilings, and floors, when properly designed and constructed, will materially lower the amount of sound transmitted from room to room; and sound-absorbing materials will reduce the noise due to interior as well as extraneous sound.

Considerable time and study has been given by the specialists of the Codes and Specifications Section of the National Research Council to the elimination of noise in dwellings in connection with the development of the Health and Sanitation Section of the National Building Code.

The Bureau of Standards, Washington, has studied the transmission and absorption of sound by materials used in construction. The materials tested were panels of lime or gypsum, with or without wooden frames, covered with a more or less smooth varnish.

The absorption of sound in the case of the same substance varies a great deal with the frequency of the sound; thus, for instance, felt, under a thickness of 25 millimetres, absorbs 94 per cent of a sound incident at a frequency of 2,190, and 33 per cent of a sound of frequency 297. In the case of some substances the maximum absorption corresponds to average frequencies. The less absorbent substances, however, lose their power of absorption in proportion as the frequency increases.

The nature and quality of the soil and the floor construction are of importance in solving vibration isolation problems. Considerable resonance may be set up and may transmit vibrations to surprising distances. The location of the machine in regard to supporting beams, building columns and main walls must be taken into consideration.

The character and intensity of the jolts and jars must be carefully analyzed; also the direction of the impacts, if vertical or horizontal, should be investigated.

Since the distributing frequency is fixed through the prevailing conditions it becomes necessary to choose an isolator which provides an adequate natural frequency and thus a satisfactory isolation efficiency. Local conditions govern the required isolation efficiency. Hotels, auditoriums, concert halls and residential sections require a greater isolation efficiency than factories, warehouses and many commercial installations.

Anti-vibration equipment may be considered under two general classifications, namely: steel spring units, and units employing organic materials, particularly natural cork, as a resilient medium. The choice between these two classifications rests mainly on limitations of local conditions and the degree of vibration isolation desired. With certain exceptions, both types can be applied directly to the machine base or legs, as well as under a sub-base or foundation. Certain steel spring units provide isolating efficiencies closely approaching 100 per cent and are considered the most accurate and successful vibration control possible. Units employing organic materials are not quite so efficient as steel

spring isolators, but also provide effective permanent and economical isolation of vibration and noise, particularly against sound transmission.

The protection of workmen is possible by the use of substances which isolate the vibration, by wearing boots with soft soles, and by using straw mats, felt braid and special chairs with springs. But all these methods of eliminating vibrations vary according to particular cases. Thus, in hammering operations the use of benches with springs, for supporting the material which is being hammered, does much to reduce the vibrations experienced by the workman at each blow.

These prophylactic measures should be accompanied by:

(a) Medical examination on engagement, which enables a selection to be made and the elimination of workmen affected by diseases of the auditory apparatus.

(b) Periodical medical examinations of workmen in noisy occupations.

(c) Measures relating to scientific organization of work; changes of shifts in noisy work; change of occupation, which is sometimes difficult to realize, or simply change of process in the same occupation; the prohibition of the employment of workmen not used to noisy work. A useful scheme consists in regulations for rest pauses.

First and foremost, proper means should be taken to protect the hearing. Numerous ear protectors have been made, but the metal kinds, which may break and allow fragments to penetrate into the interior of the ear, should be avoided.

It is of value to bear in mind that, from the economical point of view, noise, even though of slight intensity, causes a marked diminution in capacity for work, and a diminution of output which may fall as low as to 40 per cent of the normal, and an increase in labour turnover; whence follows a diminution of production.

The elimination of noises will be profitable to all concerned; to the workers, because it improves their health and their enthusiasm, diminishes absences and lessens friction between employers and employed; and to the employers because it increases output and diminishes the cost of production.

Legislation can bring efficient help in the fight against noises, first of all by recognizing officially noisy industries as dangerous trades, and then extending the benefits of compensation to industrial diseases caused by the noises.

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# EDITORIAL SECTION



## TUBERCULOSIS AND THE STUDENT NURSE

ELSEWHERE in this issue appears a paper by Doctors Collins and MacMillan on this important subject—an important subject because although it is now at least fifteen years since it has been under close study, there still remains much to be done before we have complete information on the facts surrounding it, or practical methods for dealing with the problem successfully. This paper should be read in conjunction with that published in 1935 by the same authors, and in fact, with those of other writers such as Myers, Whitney, Heinbeck, Ferguson and Ross.

That there is a distinctly increased incidence of tuberculosis in student nurses can not be gainsaid. Following the study of Doctor Ross in 1926, other papers have appeared from many countries, suggesting reasons and pointing out the necessity of such measures as the careful selection of student nurses, periodic examinations, teaching of careful technique, and even the vaccination of negative reactors with B.C.G. vaccine as a preliminary measure to the period of training.

Among the causes that have been put forward might be mentioned age, environment—including too long hours of work, lack of sufficient rest or sleep, inadequate or unsuitable diet, lack of acquired immunity in the case of pupil nurses who fail to react to tuberculin on undertaking training, and loss of acquired immunity with the evanescence of allergy in individuals whose primary infection has been entirely overcome and in which there has been absence of re-infection, which has been discussed by Miller and Rappaport.

It cannot be denied that study of this problem has been beneficial as it has focused attention particularly on environmental causes, with an improvement in all these factors.

All observers stress the importance of exogenous infection. The fact that there is still an increased incidence of tuberculosis in nurses-in-training adds proof, if proof were needed, of the importance of exogenous infection as a cause, and it is cause to which much attention has been paid and must be paid. Such attention must include proper instruction of the tuberculous patient to protect both those who surround him and care for him, proper technique in the use of gloves, gowns, masks and the washing of hands, measures rigidly applied to infectious disease and surgical wards, but often

neglected on the medical wards of general hospitals. There must also be added careful diagnosis of those hospital patients treated for other diseases, but who are unrecognized open cases of tuberculosis. Careful physical examination of the chest, sputum examination and X-ray should still be routine measures, irrespective of other diagnoses, if pulmonary disease is suspected. The passage of time will see these adopted as routine orders.

One cannot but be impressed with the rapidity with which tuberculin-negative student nurses become reactors, both in the sanatorium and in the general hospital. When we see these same nurses-in-training become tuberculous, we see the disease developing under our very eyes. It is gratifying to know that the authors have observed an evident drop in positive reactors in both student and graduate nurses. In the latter group the reduction has been less. Little change has occurred in the conversion of negative reactors to positive reactors during the course in tuberculosis. It is also gratifying to note the preventive measures which have been adopted in the training schools of New Brunswick, and it is to be hoped that the improvement noted in the survey from 1934 to 1939, over that made from 1930 to 1934, will be further accelerated.

The authors' observation that: "In nearly every instance wherein a student nurse breaks down either during the course or within one year, there has been present a positive intradermic reaction when the student nurse began the course in tuberculosis," together with "the contrast in collected figures (4.07 per cent) on morbidity among graduate nurses working in our Canadian sanatoria over a period of four years," would seem to be at variance with the results of other observers. In this connection it must be remembered that the pupil nurses entering the training schools of New Brunswick are more highly tuberculinized than the pupil nurses entering the training schools in Ontario or the Prairie Provinces, since the death rate in the White population of the latter provinces is from one-half to one-third of the rate that obtains in New Brunswick.

Evidence is accumulating that the tuberculin-positive reactor who shows no evidence by X-ray of visible previous infection is likely to fare better than the negative reactor or those who show evidence of previous but now healed disease. While it is possible to exclude the latter by a careful examination, including the tuberculin test and the X-raying of all probationers, a procedure now employed to our knowledge in practically all training schools in Canada, it has become out of the question to reject all those who do not show a positive tuberculin reaction. In the Prairie Provinces of Canada and in Ontario, it would mean the rejection of 80 per cent of applicants.

This brings us to the consideration of whether a suitable vaccine is within the realm of practical possibility. The observations of Heinbeck on this question are in favour of the use of B.C.G. Already this vaccine is being used, not only in Quebec, but in the Province of Saskatchewan. In the latter province, a study is being made under the auspices of the Associate Committee on Medical Research. These investigations should throw a great deal of light on this very important question.

*G. J. Wherrett*

## THE PROBLEM OF HOSPITALIZATION

FOR some years municipal authorities have become increasingly concerned with the problem of rising hospital charges. The increasing practice of hospitalization of self-pay patients who are in need of such service is in part due to an appreciation on the part of both the public and the medical profession of the advantages of the service offered. To presume to evaluate the significance of such other factors as contribute to the sharp rise in the demand for hospital accommodation in the last generation would serve no useful purpose. That this attitude on the part of that cross-section of the public who are unable to pay for hospital care is reffected in the increase in public ward patients is probably true. The fact remains that the problem of meeting the cost of the expanding service is annually becoming more serious. The study of the reason for the admission of some 200,000 patients to Ontario general hospitals by Dr. Sellers of the staff of the Provincial Department of Health adds materially to our limited knowledge of the types of illness which presumably call for hospital care. In the absence of morbidity data in non-communicable diseases the figures submitted present the first authoritative statement as to the extent of certain types of non-fatal illness. Some of these, particularly appendicitis and abortion, constitute a challenge to those concerned with the preventive side of medicine.

Equally significant are the data in support of the contention that the non-pay patient remains for a longer period in hospital than the self-pay patient suffering from a comparable condition. The statement that 28 per cent of all hospital patients are unable to contribute anything toward the cost of their hospital maintenance, while justifying concern, is appreciably less disturbing than that this 28 per cent constitute 43 per cent of the hospital days. This disproportion is continued into the findings in respect to chronic illness.

Dr. Sellers's observation on the potential increase in the demand for hospital care from the older group is particularly pertinent in wartime, as is the cautionary comment as to the justification for hospital expansion.

Dr. Sellers's paper justifies careful study by all those concerned either directly or indirectly with the many problems associated with hospital administration.

# THE 1940 EXAMINATIONS FOR THE CERTIFICATE IN SANITARY INSPECTION (Canada)

THE annual examinations for the *Certificate in Sanitary Inspection* (*Canada*), granted by the Canadian Public Health Association, were held in seven provincial centres on September 11th, 12th and 13th. Twenty-nine candidates completed the requirements of the Committee relating to secondary-school education and satisfactory field training in sanitary inspection. Of this number twenty-two passed in all the subjects of the examination; six were conditioned in one subject and will have to repeat it at a subsequent examination before the certificate can be granted; and one failed, having obtained less than the pass mark in two or more subjects.

The successful candidates and those conditioned in one subject are as follows:

British Columbia: H. P. Reusch, Vancouver.

Alberta: L. G. Alexander, South Edmonton (*Food Control*); B. B. Goodwin, Bellevue; E. H. Richards, Calgary.

Saskatchewan: P. W. Gibbons, Saskatoon; A. C. Hinton, Regina; P. Newall, Saskatoon.

Manitoba: F. Baker, Winnipeg; W. R. Bridges, Winnipeg; D. M. Graham, Winnipeg; T. H. Lackie, Winnipeg; I. Rose, Winnipeg (*Communicable Diseases*); M. Steiman, Winnipeg.

Ontario: J. H. Allen, Toronto; W. H. Bishop, Toronto; W. C. Boyd, Todmorden (*Communicable Diseases*); J. L. Griffith, Toronto (*Sanitation*); M. L. Hammond, Toronto; E. Lund, Toronto; D. E. Moore, Kenora; H. H. McFaul, Toronto; F. J. S. Shier, Toronto (*Sanitation*); R. E. Welsh, Camp Borden; W. G. Westover, Weston.

Quebec: V. Benoit, Montreal; J. R. Garon, Lac Megantic; J. Rancourt, Montreal (*Sanitation*).

Nova Scotia: W. J. Chisholm, Halifax.

As in past years, the responsibility for the conduct of the examinations was left with the provincial departments of health, the deputy minister of which appointed the chairman of the provincial board. The chairman is responsible for the arrangements in general, the conduct of the oral examination, and the assignment of the subjects for the field investigation report. The second member of the board is chosen by the chairman and the third member is nominated by the Canadian Institute of Sanitary Inspectors. Whenever possible, the boards consist of a medical officer of health, a sanitary engineer, and a sanitary inspector.

The Committee gratefully acknowledges the co-operation of the following members:

British Columbia: Dr. Stewart Murray, chairman; Mr. R. M. Martin, C.E., and Mr. Reginald Startup, C.S.I.(C.).

Alberta: Mr. D. B. Menzies, C.E., chairman; Dr. G. M. Little and Mr. J. Butterfield.

Saskatchewan: Mr. J. G. Schaeffer, B.Sc., chairman; Dr. G. R. Walton and Mr. M. H. Kennedy.

Manitoba: Dr. C. R. Donovan, chairman; Mr. W. D. Hurst and Mr. James Arkle.

Ontario: Dr. J. G. Cunningham, chairman; Dr. L. A. Pequegnat, and Mr. Hugh McIntyre, A.R.San.I. In addition, the Committee is indebted to the following members for their assistance in the conduct of the oral examinations: Dr. R. D. Defries, Mr. D. S. McKee and Dr. A. R. B. Richmond.

Quebec: Mr. T. J. Lafrenière, C.E., chairman; Dr. Ad. Groulx and Mr. Aimé Cousineau, C.E.

Nova Scotia: Dr. P. S. Campbell, chairman; Dr. D. J. Mackenzie and Mr. H. W. Johnston.

The examination papers in the three written subjects were as follows:

## SANITATION

(Thursday afternoon, September 12th)
Time: 3 hours

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1. John Smith, a contractor, proposes to erect a 6-room dwelling house on a lot sloping steeply toward Blank Street. He has sublet the contract for plumbing to James

Brown, a master plumber who holds a licence from the municipality. The dwelling is to have the following fixtures: Three-piece bath on the second floor, sink in the kitchen and fixed laundry tubs in the basement.

(*a*) Illustrate by a sketch, the essential parts of such an installation to the point where the connection is made to the sewer on Blank Street.

(*b*) Describe the procedure needed to obtain the approval of the municipal authorities for this installation.

(*c*) Describe the inspections that would be made by you, as an inspector of plumbing. When should such inspections be made? Include in your account any tests you might use.

2. (*a*) What diseases may be transmitted to humans by water?

(*b*) Describe the essential features of a properly located and constructed dug well.

(*c*) What are the purposes of water filtration? Name the types of water-filter plants used by municipalities and describe *one* type.

3. You have been appointed sanitary inspector of a town of 5,000 population. What information would you attempt to obtain by means of a sanitary survey and how would you proceed to conduct such a survey? Indicate the form of your report to the medical officer of health, giving suitable headings for the presentation of the findings.

4. (*a*) Describe the construction and principle of operation of a septic-tank installation for a rural home. Illustrate your answer by a sketch.

(*b*) Describe the construction and maintenance of one type of outdoor privy. What other types may be used?

5. Write short notes on the following:

(*a*) Methods of refuse disposal in an urban municipality.

(*b*) The control of flies.

(*c*) The chlorination of a municipal water supply.

## FOOD CONTROL AND LEGISLATION

(Friday morning, September 13th)
Time: 3 hours

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1. (*a*) What diseases may be transmitted to man through milk?

(*b*) A farmer with a herd of twenty cows wishes to sell milk to a dairy in a nearby city. Enumerate the various points to be observed in making an inspection for the granting of a licence, indicating the requirements which would guide you in making your report.

2. A butcher in a town of 5,000 population wishes to erect a slaughter house on the bank of a small river on the outskirts of the municipality. What requirements should be made regarding the location, construction, equipment, and operation of such a slaughter house?

3. You are required to inspect a restaurant which seats 50 persons. The owner is very willing to co-operate but has limited finances since the restaurant is in a poor section of the town. Describe your visit to the restaurant, the points you would note, and the advice you would give the owner, with special emphasis on dish-washing methods.

4. Discuss the pasteurization of milk under the following headings: (i) definition (according to the regulations of your province), (ii) the essential equipment in a small pasteurizing plant, (iii) possible defects in equipment and operation.

5. (*a*) An outbreak of food poisoning has occurred in a city. All who suffered illness were customers of one bakeshop. Describe the investigation which you would make and the inspection of the shop. What products are most likely to be the cause of the illness?

(*b*) What are the purposes of meat inspection as conducted in abattoirs? Describe the method of inspection and enumerate the conditions which may be found requiring the condemnation of a carcass.

## PREVENTION AND CONTROL OF COMMUNICABLE DISEASES AND RELATED SUBJECTS

(Friday afternoon, September 13th)
Time: 3 hours

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1. (*a*) What are the characteristics of communicable diseases?

(*b*) Write a note on the modes of transmission of communicable diseases. Give examples of diseases spread by each mode of transmission.

2. A case of smallpox is reported in a lumber camp. Discuss fully the measures which should be taken for effective control of: (*a*) the case, (*b*) the contacts.

3. For what purposes is fumigation with hydrocyanic acid gas employed? Describe in detail the procedure of fumigating a dwelling house. What safeguards must be used?

4. In a retail fruit store having living quarters situated immediately behind the shop, a case of scarlet fever occurs in a child of 7 years. The family consists of three other children of school age and two adults. What steps would you take as quarantine inspector on being notified of the case of scarlet fever? What are the regulations relating to the occurrence of scarlet fever under these circumstances?

5. (*a*) State quarantine and isolation

periods as required in your province for measles, diphtheria, and poliomyelitis.

(*b*) Name three diseases for which there are vaccines or serums for use in their prevention. Indicate in each instance how the preventive treatment is employed.

The Central Board on Examination and Registration was gratified with the results of the examination, which gave evidence that candidates are meeting the higher standards set by the Committee. It is felt that the introduction of the requirement of four years of high-school work or its equivalent in secondary-school education, which will be effective after August 31, 1941, will assist in assuring that candidates have an adequate background. In establishing this standard, the Committee desires to achieve at the earliest possible date preliminary educational requirements equivalent to those required for the employment of sanitary inspectors in England.

# PROGRAM

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# NINTH ANNUAL CHRISTMAS MEETING OF THE LABORATORY SECTION

# CANADIAN PUBLIC HEALTH ASSOCIATION

## Royal York Hotel, Toronto
## December 16-17, 1940

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### MONDAY MORNING, DECEMBER 16th

**Private Dining Room No. 9, Main Mezzanine Floor—9.00**

**9.00. Registration.** A fee of $1.00 is being charged to cover in part the expenses of the meeting.

**A Laboratory Procedure for Detecting and Eliminating Thermoduric Bacteria from Pasteurized Milk.** V. E. GRAHAM, University of Saskatchewan, and W. H. ORME, Department of Public Health, City of Saskatoon.

**The Application of the Evelyn Photo-electric Colorimeter to a Modification of the Kay-Graham Phosphatase Test.** J. WYLLIE, Queen's University, Kingston.

**Tuberculin and Its Uses.** WM. D. HAY, Queen's University.

**Papain Digest Media and Standardization of Media in General.** I. N. ASHESHOV, University of Western Ontario, London.

**The New Eighth Edition of Standard Methods for the Examination of Dairy Products.** ROBERT S. BREED, New York State Agricultural Experiment Station, Geneva.

**Preliminary Observations on the Survival of** S. typhi **in Canadian Cheddar-type Cheese.** L. E. RANTA and C. E. DOLMAN, Connaught Laboratories, Western Division, University of Toronto.

**Chemotherapeutic Study of Simple Nitro Compounds.** C. SIEBENMANN and R. J. SCHNITZER, Connaught Laboratories, University of Toronto.

**The Antitoxin Response to Tetanus Toxoid Combined with Typhoid Vaccine.** L. GREENBERG and J. GIBBARD, Laboratory of Hygiene, Department of Pensions and National Health, Ottawa.

**Blood and Blood Substitutes in Haemorrhage and Shock.** C. H. BEST and D. Y. SOLANDT, University of Toronto.

## MONDAY AFTERNOON

### School of Hygiene, University of Toronto—2.15

#### PROGRAM OF DEMONSTRATIONS

1. **The Quantitative Determination of Arsenic by Morris and Calvery's Method.** MISS I. F. MACLACHLAN, Queen's University.

2. **The Use of the Evelyn Electro-colorimeter for Vitamin C Assay.** MISS MARION CHAPMAN, Division of Laboratories, Ontario Department of Health.

3. **Blood Level Determinations in Chemotherapy by Chemical and Photo-electric Means.** J. F. FASKEN, Division of Laboratories, Ontario Department of Health.

4. **Morphological Alterations of Trypanosomes due to Chemotherapeutic Treatment.** R. J. SCHNITZER, Connaught Laboratories, University of Toronto.

5. **Kahn Verification Test.** A. L. MACNABB, Director, Division of Laboratories, Ontario Department of Health, and MISS RUBY HUGHES.

6. **Benzene Poisoning and Natural Resistance to Streptococci.** I. GODDARD and R. J. SCHNITZER, Connaught Laboratories, University of Toronto.

7. **Results of Smear and Cultural Examination on 1,000 Specimens for the Diagnosis of Gonococcal Infection.** E. L. BARTON, Division of Laboratories, Ontario Department of Health.

8. **Papain Digest Medium.** H. G. MACMORINE, Connaught Laboratories, University of Toronto.

9. **Method of Isolating Anaerobes from a Mixed Culture.** G. D. W. CAMERON, Chief, Laboratory of Hygiene, Department of Pensions and National Health, Ottawa.

10. **Transmission of Streptococci.** RONALD HARE, Connaught Laboratories, University of Toronto.

11. **Parasitological Specimens.** E. KUITUNEN-EKBAUM, Department of Hygiene and Preventive Medicine, University of Toronto.

12. **Cultivation of Virus and Rickettsia in Developing Egg and on Agar Tissue Culture.** J. CRAIGIE and N. A. LABZOFFSKY, Department of Epidemiology and Biometrics, University of Toronto.

13. **Reactions in Rabbits with Toxic Material from** H. pertussis. NELLES SILVERTHORNE, Connaught Laboratories, University of Toronto.

14. **Differentiation of Staphylococci.** REBA WILLITS, School of Hygiene, University of Toronto.

15. **Colonial Forms of Haemolytic Streptococci.** FRIEDA H. FRASER, Connaught Laboratories, University of Toronto.

16. **Action of New Phage on V and W Forms of** S. typhi. C. E. DOLMAN, DONNA E. KERR, and DOROTHY E. HELMER, Division of Laboratories, Provincial Board of Health of British Columbia.

**Tea will be served in Room 52 from 3.45 to 4.30 p.m.**

## MONDAY EVENING

### Informal Dinner, Private Dining Room No. 9, Royal York Hotel 6.30 p.m.

**(Tickets $1.50)**

### Election of Officers

Speakers: M. V. VELDEE, Chief, Division of Biologics Control, National Institute of Health, Washington, D.C.

**Immunization against Scarlet Fever**

RONALD HARE, Research Associate, Connaught Laboratories, University of Toronto

**Present Status of Influenza Virus**

### Film (in Color):

**"The Life History of the Rocky Mountain Spotted Fever Tick" prepared by the United States Public Health Service and shown through the kindness of Dr. R. R. Parker, Director of the Division of Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Montana.**

## TUESDAY MORNING, DECEMBER 17th

### Private Dining Room No. 9—9.30

**A New Phage and a Susceptible W Form of** S. typhi **isolated from a Typhoid Fever Case.** C. E. DOLMAN, DONNA E. KERR, and DOROTHY E. HELMER, Division of Laboratories, Provincial Board of Health of British Columbia.

**Isolation of Poliomyelitis Virus from Two Cases:**
**Clinical and Epidemiological Data.** H. A. ANSLEY, Department of Health of Ontario.
**Laboratory Findings.** JAMES CRAIGIE, School of Hygiene and Connaught Laboratories, University of Toronto.

**Survey of Chemotherapy in Pneumonia based on 386 cases treated by Private Practitioners.** W. B. MCCLURE, Division of Laboratories, Department of Health of Ontario.

(a) **The Incidence of Human Trichinosis in Toronto.** (b) **Report of a Case of Dipylidium caninum in a Child.** ELLA KUITUNEN-EKBAUM, School of Hygiene, University of Toronto.

**Photomicrographic Method of Recording Pathological Diagnoses in Cancer Clinics.** JAMES MILLER, Queen's University, Kingston.

**The Toxicity and Trypanocidal Activity of Commercial Neoarsphenamine.** C. A. MORRELL and M. G. ALLMARK, Laboratory of Hygiene, Department of Pensions and National Health, Ottawa.

**Studies on** H. pertussis. NELLES SILVERTHORNE, Connaught Laboratories, University of Toronto, and Hospital for Sick Children.

**The Quantitative Determination of Arsenic in Limestone Rocks by a Modification of Morris and Calvery's Technique.** J. WYLLIE, Queen's University, Kingston.

## TUESDAY AFTERNOON

### Private Dining Room No. 9—2.30

**Report of a Trial of a New Schick Toxin.** G. D. W. CAMERON, Laboratory of Hygiene, Department of Pensions and National Health, Ottawa.

**The Concept of Bacterial Equilibrium and its Possible Application to Soil Problems.** A. G. LOCHHEAD, Department of Agriculture, Ottawa.

### Discussion on Wound Infections

**The Rapid Identification and Chemotherapy of the Anaerobes.** G. B. REED and J. H. ORR, Queen's University, Kingston.

**Some Observations on Experimental Infection with** Clostridium bifermentans (sordellii). T. E. ROY, Department of Bacteriology and Immunity, McGill University.

Title to be announced. P. H. GREEY, Banting Institute, University of Toronto.

**Aerobic Gram-positive Bacillus infecting Wounds.** JANET HUTCHESON, St. Michael's Hospital, Toronto.

**The Value of the Plasma Coagulase Test in the Recognition of Pathogenic Staphylococci.** D. H. STARKEY and M. F. HOWIE, Department of Bacteriology of the Royal Victoria Hospital and McGill University, Montreal.

**Haemolytic Steptococcal Infection.** REBA WILLITS, School of Hygiene, University of Toronto.

# PUBLIC HEALTH ADMINISTRATION

## The Annual Meeting of the American Public Health Association

THE sixty-ninth annual meeting of the American Public Health Association was held in Detroit during the second week of October. Within the four days of the meeting more than sixty sectional and other programs were presented. Each of the ten Sections of the Association provided one or more programs. The general sessions, four in number, were of particular interest. Two of these dealt with problems arising out of war. One was devoted to venereal diseases, the speakers including the Surgeon Generals of the Army and the Navy, and the other to the control of communicable diseases under wartime conditions. In keeping with the urgency of the present situation, Dr. W. S. Leathers of Vanderbilt University brought before the convention, in his presidential address, the important place of public health in national defence.

The program committee has continued to vary the form and style of the program. The panel type of presentation was used for several sessions. An innovation was the dramatic presentation of arguments for adequate school health services entitled "Public Hearing on Anytown's Health Budget." It related to the defence of an increase of thirty thousand dollars advocated by health experts and the citizens' committee.

It was a matter of regret to many Canadian members that war conditions made their attendance impossible. It was gratifying, however, that the Canadian delegation numbered forty-three. Each year members from Cuba, Mexico, and Canada have been included among those nominated for election to the Executive Council and as officers, thus emphasizing the international character of the Association. Of the three vice-presidents elected at the Detroit meeting, Dr. Carlos Findlay is from Cuba and Dr. R. D. Defries is from Canada. The Association's desire to maintain its international character merits the full support of Canadian public health workers.

From every standpoint the sixty-ninth annual meeting was one of the most successful that the American Public Health Association has held. The registration was three thousand. As chairman of the local committee and president of the Michigan Public Health Association, Dr. Henry F. Vaughan, Commissioner of Health of Detroit, was largely responsible for the excellent arrangements and the great success of the meeting. The seventh Institute on Public Health Education, which was held in advance of the meeting, had a registration of more than eight hundred, evidencing the keen interest of public health workers in the opportunities afforded by the institute meetings.

## Scarlet Fever Immunization in Hamilton, Ontario

BEGINNING in 1936, the Department of Public Health of Hamilton decided to study the value of scarlet fever immunization. Immunization on a voluntary basis was offered to the children in several west-end schools. Notices were sent to the parents explaining the test. The children who presented themselves for immunization were given a Dick test. The positive reactors were given five doses of scarlet fever toxin, as provided by the Ontario Department of Health. Ten days after the last dose, a second Dick test was made to determine whether or not immunity had been established and the treatment was continued where indicated. Altogether, 2,421 children in fifteen schools have been immunized.

Since we have just passed through a severe epidemic of scarlet fever, we thought it would be a good time to estimate, if possible, the value of this

type of immunization. From September 1939 to July 31, 1940, inclusive, 1,661 cases of scarlet fever were reported, their age distribution being as follows: 489 (29.4 per cent) of the cases were in the pre-school group, 916 (55.1 per cent) were in the school group, and 256 (15.4 per cent) were over 16 years of age.

Only 6 of the 2,421 children immunized were reported as having had scarlet fever in the epidemic—an incidence of .36 per cent. There were 27 cases of authentic second attacks and 1 case was recorded as having a second and a third attack. In five cases the first attack showed all the symptoms but without desquamation, and the second attack all the symptoms with desquamation. There were 4 cases in which the first attack showed all the symptoms and desquamation, the second attack all the symptoms and no desquamation. There were 18 cases in which both attacks showed symptoms and desquamation.

In each of two families, three immunized children escaped, while one child not immunized developed scarlet fever. In another family, four immunized children did not take the disease, while one non-immunized child did. In still another family, five non-immunized children contracted scarlet fever, while four immunized children escaped.

The incidence of scarlet fever from September 1939 to July 31, 1940, among the immunized and the non-immunized school population, was as follows: in fifteen schools where part of the children had been immunized, there were 144 cases among the 5,353 pupils—a rate of 2.6; while in the remaining 36 schools, in which immunization was not done, there were 772 cases among the 18,565 pupils—a rate of 4.1.

Among the 2,421 children immunized who received a total of 12,105 treatments, there were complaints of severe reactions in less than a dozen instances and these reactions completely subsided within two or three days.

While many factors might enter into such a comparison to vary the result, it would seem that a campaign of immunization against scarlet fever carried out on the same line as the diphtheria-immunization campaign might be very much worth while.—*J. E. Davey, Medical Officer of Health.*

### FORMATION OF TWO NEW HEALTH UNITS IN ALBERTA

Two new health units were opened in Alberta in November, one to serve the area known as the Sturgeon School Division, and the other the district surrounding the towns of Olds and Didsbury.

The Sturgeon Division is one of a number of enlarged school divisions that have been formed in Alberta. These divisions are administered by a central board and are under the direction of a superintendent, who also acts as inspector of schools. The Sturgeon district is north of Edmonton and covers an area of approximately thirty miles from east to west and forty miles from north to south. Part of the southern section of the division is contiguous with the northern boundary of Edmonton. The division has a population of 18,000, largely Anglo-Saxons, French-Canadians, and others whose racial origin is Central European. The school population numbers 4,000. The unit is financed by a budget of eleven thousand dollars, half of which is contributed by the Provincial Department of Health and half by the School Division. Dr. R. Young is medical officer of health, and Miss Elizabeth Sage and Miss Fernande Primeau, of the Provincial Department, have been appointed to the nursing staff. Miss R. M. Perras is secretary-technician.

The second unit, serving the district around the towns of Olds and Didsbury, is forty miles north of Calgary. The territory comprises six municipal districts and has a population of 15,000, chiefly Anglo-Saxons. Dr. J. C. MacPherson, formerly with the Tuberculosis Division of the Provincial Department, has been appointed medical officer of health. Miss Margaret Har-

greaves, formerly of the Stettler Health Unit, is the nurse in charge, and the second member of the nursing staff is Miss Mary Dunne, formerly of the Red Deer Health Unit. Miss Rigglesworth is secretary-technician.

With the creation of these units, there are six full-time health units in operation in Alberta. Plans have been made for the formation of two or three additional units in the near future.

### DIPHTHERIA IMMUNIZATION IN NOVA SCOTIA

AN active campaign of immunization against diphtheria is being conducted in Halifax and in other centres in Nova Scotia following an outbreak in Halifax during November. Cases have occurred among adults as well as children and several deaths have been reported.

### APPOINTMENTS

DR. ROBERT D. Defries has been appointed Director of the School of Hygiene and of the Connaught Laboratories, University of Toronto. During the past twenty-five years he has been prominent in the work of these two institutes, having early in 1915 become actively associated with the late Dr. J. G. FitzGerald, whom he now succeeds.

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DR. Charles H. Best, University of Toronto, has been appointed a Scientific Director of the International Health Division of The Rockefeller Foundation, to serve for a term of three years. Dr. Best is the second Canadian to be so honoured, the late Dr. J. G. FitzGerald having served on this board.

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DR. A. Hardisty Sellers, Medical Statistician of the Department of Health of Ontario, has been appointed Flying Officer in the medical division of the Royal Canadian Air Force and is now stationed in Ottawa. He has been given leave of absence from the Department for the duration of the war.

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MISS Heather Kilpatrick has been appointed Director of Nurses in the Provincial Board of Health of British Columbia.

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DR. John Howie, D.P.H., formerly of London, Ontario, has been appointed acting Medical Officer of Health of Windsor, Ontario, during the absence of Dr. Fred Adams, D.P.H., who is serving with the Canadian armed forces.

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DR. Alan Young, District Physician of the Department of Public Health, City of Toronto, has been appointed Flight Lieutenant in the medical division of the Royal Canadian Air Force.

# CURRENT HEALTH LITERATURE

*These abstracts are intended to direct attention to articles that have appeared in other journals during the past month. Any of the journals referred to may be borrowed for three days or longer if desired. Address requests to the secretary of the Editorial Board.*

## Eleven Years of Diphtheria Immunization in a Rural District

THIS paper is an account of eleven years' experience of mass immunization in a scattered rural district. In this particular district peak years of diphtheria incidence were 1913, 1921 and 1929, and a peak was expected in 1937. Up to the present no increase has occurred. Immunization began in 1929 and by the end of 1939, 4,000 children under 15 had been inoculated, a number equal to about 45 per cent of the child population.

The methods used to secure the interest and co-operation of parents, children and school authorities are described. Success of the methods is shown by the steady rise in the number of consents. Compulsory immunization was felt to be unwise and lectures to parents were felt to give better results than pamphlets. The method of injection, the antigens used, and the place of the Schick test are discussed.

Other observations of interest are made. In three instances the only uninoculated child in a household contracted diphtheria, whereas the remaining children escaped. Four children contracted severe faucial diphtheria one month after inoculation but no case of clinical diphtheria occurred in any child who had been inoculated for three months or more. Outbreaks in certain villages were apparently terminated by means of inoculation.

G. Nicholson and Audrey Z. Baker, Brit. M.J., Sept. 14, 1940, p. 354.

## Sulfanilamide as a Preservative in Stored Blood

THE author presents experimental results which confirm the findings of Milan Novak (1939) with regard to the efficacy of sulfanilamide in small amounts as a bacteriostat for refrigerated stored blood. Rabbit's blood was contaminated with various organisms, and to different portions sulfanilamide was added to give concentrations of 1:1250, 1:2500, and 1:5000, further portions being kept as controls. Plate counts were done immediately and at intervals during a 29-day period. In all instances a decrease in the number of organisms resulted. In another experiment similar concentrations of the drug were tested using oxalated horse blood collected without any aseptic precautions. In this case the 1:1250 and 1:2500 concentrations of sulfanilamide were effective while the 1:5000 was not.

It is evident that low concentrations of sulfanilamide exert a preservative effect in blood stored at refrigerator temperature, at least when the initial concentration is very small, as it would ordinarily be when aseptic precautions are observed in collection. Wastage and danger may be overcome by application of this information. The dose of sulfanilamide introduced in a 500 c.c. transfusion would be extremely small.

R. F. Hunwicke, Brit. M.J., Sept. 21, 1940, p. 380.

## The Effect of Large Doses of Vitamins A, B, C and D on the Incidence of Upper Respiratory Infections in a Group of Rheumatic Children

THIS investigation was prompted by the well-recognized importance of upper respiratory infections, especially when due to Group A beta haemolytic streptococci, as a cause of recurrence of rheumatic symptoms and the hope that the incidence of such infections might be lessened. Previous studies of vitamin A by various workers failed to establish its "anti-infective" value but careful study of combined vitamin prophylaxis was lacking. One hundred and eight rheumatic children in an institution where they could be closely supervised were

divided into two groups, one group receiving the regular diet plus vitamins A, C, D and B complex and the other group receiving the regular diet without additional vitamins. Careful laboratory and clinical observations were made during the winter months of two years. During this time there were 56 cases of streptococcus pharyngitis and 51 cases of influenza. The incidence of these infections among the children receiving vitamins and those in the control group was essentially the same. Gain in weight by the members of the two groups was also approximately the same.

A. G. Kuttner, J. Clin. Invest., 1940, *19*: 809.

### A Common Error in Obtaining Specimens for the Cultural Diagnosis of Gonococcal Infection in Women

THIS study confirms the value of the cultural method for detection of gonococci, particularly in chronic and treated cases, and indicates a marked superiority over the "smear" method. It was found, however, that the use of lubricant on the speculum during collection of material reversed the above situation, the "smear" method becoming more efficient than the cultural method. This finding may explain the lack of success with the cultural method experienced by some venereal-disease clinics and diagnostic laboratories.

F. G. Gillick, S. E. Sulkin and L. J. Stephens, Ven. Dis. Inform., 1940, *29*: 288.

### Sulfanilamide in the Treatment of Erysipelas

EIGHTY cases of erysipelas treated with sulfanilamide at the Boston City Hospital in the past two and a half years are reviewed and contrasted with 80 cases treated without sulfanilamide during the previous two and a half years. The analysis of cases is preceded by a short account of the etiology, clinical picture, prognosis and mortality rates and the various therapeutic measures, including the use of antitoxin, which have enjoyed popularity at different times. The results of various workers following the sulfanilamide treatment are pointed out.

The two groups dealt with here were approximately similar with respect to age, debilitating and complicating diseases, and other factors known to influence the prognosis. Treatment apart from sulfanilamide was essentially the same in the two groups. In evaluating the results, the duration of fever, the average of hospital stay, the incidence of complications, and the mortality were taken as criteria. The drug-treated group returned to a normal temperature two days earlier than the controls, hospital stay was shortened three days, complications were less than half as frequent, and mortality was one-fourth that of the control group.

J. A. Foley and E. R. Gasuna, J.A.M.A., 1940, *115*: 672.

### Types of Tubercle Bacilli in Lesions of Garbage-fed Swine

THE carcasses of 264 garbage-fed swine were subjected to careful postmortem examination for evidence of tuberculosis and gross lesions were found in 75 or 28.4 per cent. Infection was apparently limited to glands of the head, neck and mesentery. Laboratory examination consisted of tissue-section study, inoculation of culture media and injection of guinea pigs with emulsified gland material. Tubercle bacilli were demonstrated by the above methods in 47 of the 75 specimens. Typing of the organisms was carried out by injection of guinea pigs and rabbits. Human tubercle bacilli were identified in 12 or 25.5 per cent and avian in 35 or 74.5 per cent. Bovine strains were not found.

That measures to control the feeding of garbage to swine are justified is amply evidenced by the above figures. The absence of infection due to bovine tubercle bacilli undoubtedly indicates a low incidence of tuberculosis in cattle in the area of study. The presence of tuberculous lesions in swine, particularly when due to human strains, indicates a possible occupational hazard to slaughter-house employees and meat inspectors.

W. H. Feldman, Am. J. Pub. Health, 1940, *29*: 1231.

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# CANADIAN PUBLIC HEALTH JOURNAL

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